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REPORT

OF

THE SECRETARY OF WAR,

COMMUNICATING,

In compliance with a resolution of the Senate of February 4, 1859, Major Barnard's Essay on the Dangers and Defenses of New York.

JANUARY 17, 1860.—Read, and referred to the Committee on Military Affairs and the Militia. Motion to print referred to the Committee on Printing.
JANUARY 24, 1860.—Report in favor printing submitted, considered, and agreed to.

WAR DEPARTMENT, *January* 5, 1860.

SIR: In compliance with a resolution of the Senate of the 4th of February last, I have the honor to transmit herewith a copy of an Essay on the Dangers and Defenses of New York, by Major J. G. Barnard, of the corps of engineers.

Very respectfully, your obedient servant,

JOHN B. FLOYD,
Secretary of War.

Hon. J. C. BRECKINRIDGE,
President of the Senate.

AN ESSAY ON THE "DANGERS AND DEFENSES" OF NEW YORK, ADDRESSED TO THE HON. J. B. FLOYD, SECRETARY OF WAR, BY MAJOR J. G. BARNARD, CORPS OF ENGINEERS, UNITED STATES ARMY.

NEW YORK, *January* 27, 1859.

SIR: In accordance with the permission kindly given me, as the engineer officer in charge of an important portion of the defenses of New York, to communicate my views to you in writing on this most momentous theme, I submit to you the following pages, trusting that its intrinsic interest, and the variety of topics I have found it necessary to treat, will be my apology for the unexpected volume to which they have swollen.

I am, sir, very respectfully, your most obedient,

J. G. BARNARD,
Major Corps Engineers, United States Army.

Hon. JOHN B. FLOYD, *Secretary of War.*

THE DANGERS AND DEFENSES OF NEW YORK.

In a paper prepared nearly a year ago, but which, from circumstances unnecessary here to explain, has not yet gone out of my possession, I used the following language, which will now answer my purpose as a brief sketch of what I consider to be "the dangers" to which New York is exposed, and as an introduction to what I shall say as to the defenses required:

* * * * "It seems to me proper to allude to the entire change in the nature of the problem to be considered in the defense of this city, since the system under which the existing works have been constructed was adopted—or, rather, since the defense of New York, as a part of the general system of coast defense, was decided upon by the board of engineers of 1816."

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"As late as 1840 I find the chief engineer, in describing the then existing works at the Narrows, (viz: the present Fort Hamilton, Fort Lafayette, on the Long Island side, and the old Forts Tompkins and Richmond, and Batteries Hudson and Morton, on Staten Island,) reporting that, (when these old works shall have been repaired,) 'with the Narrows thus defended, and the works near the city in perfect order, New York might be regarded as pretty well protected against an attack by water through this passage.' And more explicitly he elsewhere states, with regard to repairs of the old works just named on Staten Island, 'nothing further, indeed, being contemplated for this position, except the construction of a small redoubt on a commanding hill a little to the southwest.'"

"When it is borne in mind that, since the quite recent date of the report from which these quotations are taken, (1840,) there has been constructed a *new* Fort Richmond, of three or four times the size of the old work; that a large *new* work, in place of Fort Tompkins, has been commenced; that a new water-battery nearly equal to Fort Richmond has been recommended and planned by the present board of engineers; in fact, that an enormous increase of works has been decided to be necessary over those thus cited by the chief engineer as sufficient to render New York 'pretty well protected by water through this passage,' it seems to me evident that the problem involved in this 'protection' has changed its character."

"These remarks are not made as a criticism upon former boards or the chief engineer, but to show that a defensive system for New York, such as is now demanded, has never been contemplated as a whole, and that the problem, as it now presents itself, is a modified and enlarged one.

"It has undergone this change through the immense developments which have been exhibited in the means of maritime attack within the last few years, and also the rapid growth of the city itself, and of the nation of which it has become the commercial metropolis. Indeed, the experience which the nation has had when the defensive system of 1816 was adopted, was not such as could prompt a system adapted to our present circumstances. While formidable invasions of our terri-

tory had been made by land, the small works then in existence on Governor's and Bedlow's islands had proved sufficient to protect the city; and such efforts as were made elsewhere against our maritime places proved how weak were the powers of attack of that day against fortifications—how little was required to secure our seaports and maritime cities. While the means of maritime attack have of late years assumed a magnitude and formidableness not dreamed of when our defensive system was planned, and our country has so increased in population, wealth, and military resources, that no enemy can hope to make any impression by an invasion of our territory, our great maritime places, like New York, have, on the other hand, increased in even greater proportion in everything that could make them objects of attack."

"The works deemed adequate in former years for the defense of New York could not, therefore, in the nature of things, be adequate at the present day."

"The recent war of England and France against Russia may illustrate my meaning, for it has taught us what to expect were either of these nations to wage war against the United States."

"No invasion of territory—no attempt at territorial conquest—was made or thought of; for it was well foreseen that no decisive results would flow from such means. The war consisted exclusively in attacks upon maritime places—great seaports—seats of commercial and naval power. Such places, by their vast importance to the well-being and prosperity of a nation—by the large population and immense amount of wealth concentrated in them, and by their exposure to maritime attack, offer themselves at once as points at which the most decisive results may be produced. Cronstadt, Sebastopol, Sweaberg, Kinburn, Odessa, Kertch, Petropauloski, and other places of less note, were, in succession or simultaneously, objects of attack; while such as the first named became, indeed, the true seats of war."

"Around Sebastopol assailed and assailant gathered their resources, and on the result of the arduous struggle may be said to have turned the issue of the war. Had it not been so decided *there*, Cronstadt would have been the next field of combat, for which, indeed, the allies had made the most enormous preparations."

"Is it not certain that, in future, all war of maritime powers against the United States will take a similar course? All territorial invasion being out of the question, it is against our great seaports and strategic points of coast defense—such as New York, New Orleans, and San Francisco, pre-eminently New York—that an enemy will concentrate his efforts. Against these he will prepare such immense armaments—against these he will call into existence special agencies of attack—which shall (unless met by an inexpugnable defensive system) *insure* success."

"The mere defense of the city against *ordinary fleets* is no longer the question; but, *through the defensive works to be here erected, the nation is to measure its strength against the most lavish use of the resources of a great maritime nation, aided by all that modern science and mechanical ingenuity, in creating or inventing means of attack, can bring against them; in short, in fortifying New York, we are really preparing the*

battle-field on which the issue of future momentous contests is to be decided."

I most respectfully invite your attention to the last paragraph here quoted. No language that I could now use would convey a stronger idea of my profound sense of the real dangers of New York. If the conclusion that I arrive at is well founded, it demands the instantaneous attention of the War Department and of Congress. If this conclusion is well founded, then there is no topic connected with the question of national defense which will have a stronger bearing on these constantly-recurring issues with foreign nations, in which we see the war-cloud gathering which may *yet*, ere long, burst upon us, than this same topic of the "defense of New York."

I will say more specifically that on the alternative whether, on the one hand, New York is open to the attack of a maritime force, or liable to be sacked by the sudden dash of an army landed in the vicinity, or, on the other, is so securely defended by water and land that it may hurl the invader back to the ocean, will depend *greatly* the issue of peace or war.

It is a species of folly approaching to insanity for a nation to be so constantly holding up to its neighbors the momentous issue of war—so unavoidably liable to constant entanglements with the most powerful nations on the face of the earth, and yet to leave this great commercial metropolis liable, the very day almost that war is declared, to the most fearful blow.

It is estimated that the great fire of 1835 destroyed $17,000,000 of property. Yet its ravages were confined to a very limited area. How, in money or in words, could we estimate the loss of property, the destruction of military and naval armaments and stores, the paralysis of the nation's commerce, the shock upon our warlike power, the disgrace upon our escutcheon, which would or might result from a successful attack, and a more or less prolonged occupation of the post and harbor?

I trust, sir, I have succeeded in impressing you with a vivid idea of the "dangers" to which New York is exposed, and of the importance of its perfect defense. If so, then I am sure you will concur with me in the opinion that, not as a local question concerning New York merely, nor of the State of New York, nor any sectional group of States, but as a *great national* question, one in which the issues of peace or war, of national triumph or national disgrace are involved, the prompt organization of a complete and adequate system of defense for New York is demanded.

To say what this defensive system should be will, perhaps, be more difficult. I have said before that the subject *as a whole* had not yet been discussed in the new light in which recent years have presented it. I could, therefore, on many points, give only individual opinions, and, of course, these must be very general in their nature.

But, even in attempting to give such opinions, I am met by the embarrassing fact that the shadow of *doubt* has been recently thrown over even the elementary principles, which have generally governed our defensive works, by high authority. Even yourself, sir, seem to have found reason to entertain such doubts.

Far be it from me to desire to withhold from the freest discussion anything connected with this great question. I have assumed the problem of the defense of New York to be a *new* one. I am willing, if you choose, sir, that it should be so considered, in its simplest elements; and, still further, as every species of battery, armed with such artillery as we now have, whether it be the simple earthen parapet, or the massive castellated structure, lifting its numerous guns, tier upon tier, are confessedly inadequate (without auxiliary aid of *some* kind) to the perfect sealing up of a channel against the rapid *passage* of a hostile fleet, I shall be the first to hail the inventor, be he one whose "functions are confined to the most elevated branch of military science," or to the workshop of the mechanic, who will provide us with something which *will do this*.

In attempting to discuss the merits of our coast defenses, one is met in the very outset by the opposing character of the criticisms by which they have been assailed. It is now scarce twenty years since the entire system was subjected to severe animadversions from the then highest military authority of the government; from one whose public services, military and civil, and high position and character, gave great weight to his strictures.*

It was maintained by the authority to whom I refer—

"1. That, for the defense of the coast, the chief reliance should be on the navy.

"2. That, in preference to fortifications, floating batteries should be introduced whenever they can be used.

"3. That we are not in danger from large expeditions; and, consequently,

"4. That the system of the board of engineers comprises works which are unnecessarily large for the purposes they have to fulfill."

It was owing to these strictures that the House of Representatives, by resolution of May 9, 1840, called upon the War Department "to lay before this House, as soon as practicable, a report of a full and connected system of national defense," &c.

The subject was referred by the War Department to a board of officers of the army and navy, among whom was the present chief of engineers. The report of that board, (see Doc. 206, H. R., 26th Congress, 1st session,) fully indorsed by the then Secretary of War, Mr. Poinsett, is universally admitted to be one of the most able and comprehensive expositions of the whole subject of coast defense extant, and, *generally*, as a complete refutation of the strictures upon our actual system.

This discussion has become now somewhat out of date. I shall allude to it, however, to call your attention to the two last strictures there made against our system, viz:

"That we are not in danger from large expeditions, and, consequently, that the system of the board of engineers comprises works which are unnecessarily large for the purposes they have to fulfill," and to ask you to bear in mind that the engineers are *now* censured,

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* See Senate Document No. 293, page 1, 24th Congress, 1st session, vol. 4.

(whether deservedly or not, is not now the question,) for having been for the last twenty years carrying on its constructions under this very assumption that we are *not* "in danger from large expeditions."

The report which I have mentioned may be said to have silenced opposition for the next ten years, but it will (as I have said before) be considered out of date at present, owing to rapid developments since made in means of maritime attacks. I therefore pass to a more recent animadversion upon the system.

In 1851 the following resolutions were adopted by the House of Representatives:

"1. *Resolved*, That the Secretary of War be directed to report to this House, the second Monday in December next, on the subject of the land defenses of the country, in which he will review the general system adopted after the war with Great Britain, and since pursued, in regard to the permanent fortifications then deemed necessary for the national defense; and that he report whether the general plan may not now be essentially modified by reducing the number of works proposed to be erected, and by abandoning some of the forts now in progress of construction.

"2. *Resolved*, That the Secretary of War also report the number of fortifications which have been built, including those nearly completed, under the general system; the number in progress of construction, and the number not yet commenced, but proposed to be erected, and in such form as will conveniently show the States and Territories in which the several forts are situated, or to be located; when the work was commenced; when completed, or expected to be finished; the number and caliber of the guns mounted, or to be mounted; the estimated cost, the amount expended, and the sums yet required to finish or construct, as the case may be, each work."

And the Secretary of War, to carry them into effect, addressed the following queries to several distinguished officers of the army and navy.*

"1. To what extent, if any, ought the present system of fortifications for the protection of our sea-board to be modified, in consequence of the application of steam to vessels-of-war, the invention or improvement of projectiles, or other changes that have taken place since it was adopted in the year 1816?

"2. What reliance could be placed on vessels-of-war, or of commerce, floating batteries, gunboats, and other temporary substitutes for permanent fortifications?

"3. Is it necessary or expedient to continue the system of fortifications on the northern lakes?"

The character of the strictures with which the defensive system was then assailed may be judged from the resolutions of Congress and from the queries proposed. *Essentially* they were the same which we are continually hearing *now*—the same which forever *will* be heard to the end of time upon *all* established systems—viz: that it was *behind the*

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*These officers were Commodores Stewart, Morris, and Perry, Commanders Cunningham and Dupont, Lieutenants Lanman, Maury, and Dahlgren, of the navy; General Totten, Colonels Thayer and De Russy, Majors Chase and Delafield, of the engineers.

times. Railroads, telegraphs, increase of population, war steamers, and steam ocean navigation generally, and BIG GUNS in particular, had rendered the system of defense quite obsolete.

As to the replies of these several navy and army officers, it may be briefly stated that the defensive system was sustained by Commodores Stewart and Morris, Commanders Cunningham and Dupont, Lieutenants Lanman and (with qualifications) Dahlgren, of the navy, and by General Totten, Colonel De Russy, and Major Delafield, of the engineers.*

That it was opposed or censured, as requiring modifications, by Commodore Perry and Lieutenant Maury, of the navy, and Major Chase, of the engineers.

Now, it must be borne in mind that all the recent "changes" which are *now* supposed to have rendered our maritime defensive works obsolete or "old-fogyish"—viz: increase of population; great concentration of wealth, population, and national resources in our great cities; railroads; telegraphs; ocean steam navigation, and the consequent facility of bringing upon our coasts suddenly large armies in steam fleets; improvements in caliber and character of sea-coast and naval ordnance; horizontal shell firing, &c.—were then well known, and, indeed, formed the foundation of the strictures of that day. What has happened since has been but the developments in reality of what was then foreseen.

If there is any exception to the broad statement just made, it is found in the recent improvements in small arms; but this is a matter which I conceive to have very little bearing on the topic in hand.

A few quotations, therefore, from the replies of these officers who opposed or demanded modifications in the system will be interesting for comparison with the views of objectors of the present day.

Commodore Perry says: "And, besides, we have the experience of history to show that extensive military works are alike destructive of the prosperity and the liberties of the people, saying nothing of the enormous cost of construction and the keeping them in condition for service. I may instance the fortresses of Spain, of Portugal, and of the former republics of Genoa and Venice, as gigantic works, now of little use, and looked upon by the voyager only as monuments of the extravagance and peculating spirit which, at the time of their erection, characterized the people of those governments.

"Experience, moreover, shows that while the fortifications of San Juan de Uloa, at Vera Cruz; the Moro, of Havana; the castle protecting the harbor of Carthagena, upon the coast of Colombia; the Venitian fortress of Napoli di Romania, in Greece; the Castle of St. Elino, in Malta, and many others of similar extent and character, are considered by some impregnable; they command only a circuit embraced within the range of their guns, and cannot, in any manner, prevent a landing of the enemy upon the coast beyond the extent of such range; in a word, these works are useful only to command the entrances of the ports which they were intended to defend, and to cover with their

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*Colonel Thayer did not respond; his opinions, however, were well known.

guns vessels anchoring in their immediate vicinity. The celebrated fortress of Gibraltar neither commands the passage of the straits nor the anchorage on the Spanish side of that name. They are, in truth, like chained monsters, harmless beyond the reach of their manacles; not so with their steam batteries—*they* have the means of locomotion, and *their* power can be made effective at any point upon the coast capable of being reached by an enemy's vessel.

"Of all the coasts of Europe that of Great Britain is least provided with fortifications, and yet her soil has not been trodden by a successful enemy since the conquest; solely protecting her military and naval arsenals by perfect and *well garrisoned* works. She depends mainly for defense of her coast upon her navy and the warlike spirit of her yeomanry; and the very absence of fortified works prevents a deceitful reliance upon such defenses, and keeps alive the more gallant and more certain dependence upon their own personal prowess."

"And thus it should be with us. Man to man, the Americans are at least equal to any other race, and they are fully capable of driving back to their ships or capturing any number of troops that might have the temerity to land upon our soil."

Lieutenant Maury says:

"Now, were it possible for an enemy, with the greatest army that was ever led into battle by the greatest captain, to take the country by surprise, and to land at Long Island sound or in Lynn Haven bay, and to be disembarking his last piece of artillery before he was discovered, these railroads, the power of steam, with the aid of lightning, would enable the government, before he could reach the heights of Brooklyn or the outskirts of Norfolk, to have there in waiting and ready to receive him and beat him back into the sea a force two to one greater than his, however strong."

"Suppose that in 1847 there had been in active operation between Vera Cruz and the city of Mexico a line of magnetic telegraph and such a railroad as is the Erie road of New York, can it be supposed that our generals, being cognizant of the facts, would have so much as entertained the idea of landing there as they did, and laying siege to the town?"

"All the world knows where our railroads are, and that the country is protected from military surprise and invasion from the sea by a net-work of telegraphic wires; the mere knowledge of the fact that Norfolk and New York can bring to their defense such resources will forever prevent even the thought in the mind of an enemy of landing in force at Lynn Haven bay or on Long Island."

"These roads, therefore, render a siege to any of the works of defense before those places out of the question."

"To lay siege to any place along our sea front involves not only the disembarking of an army, but the landing also of the siege train. This requires time."

"From the time that the head of our invading column jumped out of the boats, up to their waists in the water, at Vera Cruz, till General Scott was ready to send his summons to the city, was thirteen days, and it was four days more before his heavy artillery drew overtures from the besieged—total, seventeen days.

"Imagine an army, the best equipped, it may be, the world ever saw, that should attempt to beleaguer one of our strongholds for seventeen days. Within that time, we could bring against him, by railroads and steamboats, millions of the freemen which this country ever holds in reserve to fight its battles. It might be Boston before which this imaginary army is supposed to set down in imaginary siege; or it may be New York, Philadelphia, Norfolk, Charleston, or New Orleans; it is immaterial where. In less than half the Vera Cruz time, we could throw millions of men into any of these places, and subsist them in the meantime by a daily market train of cars and steamboats, catering for them in the abundant markets of the Mississippi valley."

"It is impossible that any army, however brave, spirited, and daring, should ever think of invading a country like this, and attacking us upon our own ground, when we have under our command such powers of concentration, and such force in reserve as twenty millions of freemen, the electric telegraph, the railroad car, the locomotive and the steamboat."

And again, alluding to an invasion of Washington:

"Now, is it not obvious, supposing the country to be in a reasonable state of preparation at the commencement of war—supposing this much, is it not obvious, by sending telegraphic messages, and using the powers of steam for conveyance, the American general might sit down here, in Washington, and at daylight the next morning commence an attack upon that enemy, both in front and rear, with almost any amount of force, consisting of regulars, volunteers, and militia, that can be named. Retreat, for such a foe, would be out of the question, and reëmbarkation an impossibility."

"Therefore, so far as the system of 1816 was intended to defend the country from invasion along the Atlantic sea-board, steam, railroads, and the telegraph have rendered it as effete as did the invention of firearms the defenses which the military science of that age had erected against the shafts of the archer."

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"Suppose the system of 1816 to have been completed, that the fortifications therein contemplated had all been built, provisioned, equipped, and garrisoned. Now, saving only those which protect the large cities from the guns of men-of-war, suppose the alternative should be presented to our military men, whether they would undertake to defend the country from invasion, with such a complete system of fortifications, but without the assistance of railroads, steamers, and telegraph, or with the assistance of railroads, steamers, and telegraph, but without the aid of fortifications."

"I suppose, could such an alternative be submitted to every officer of the army, from the oldest to the youngest, that there would be but one answer, and that would be, 'down with the forts, and give us the railroad, the locomotive, the steamboat, and the telegraph!'"

But even Lieutenant Maury does not *dispense* entirely with forts. He says further: "It is chiefly *to keep such ships* (i. e. ships-of-war) *from burning our cities and havens*, within reach of their broadsides, that we want forts and castles."

Exactly so; it is just *for that;* and if he had said burning our cities and occupying our havens, (using the terms "forts and castles," technically,) I might almost say, *only that*, that we want them.

But we have seen already that the cry "down with the forts, and give us the railroad, the locomotive, the steamboat, and the telegraph," don't mean "down" with *all* forts, but only such as we do not want *to protect "our cities and havens;"* a very important qualification, certainly, as few or none have been built with any other design than this. Furthermore he says, "the forts already completed, or well advanced towards completion, are believed to be sufficient for this." At the date this was written, the great port of the Pacific, San Francisco, had not a "fort" even begun; the great port and commercial metropolis of the Atlantic, New York, had not, on its great avenue of approach, the Narrows, works at all capable (see the opinion of Dahlgren, a brother officer, and one of the very ablest officers of the navy, printed in juxtaposition to Lieutenant Maury's) of protecting this great city from burning by the "broadsides" or curved fire of ships-of-war. But this is but a specimen of the accuracy and soundness of criticism with which our defensive system has usually been assailed.

Lieutenant Maury, however, argues that "if one gun, in open battery on the shore, whether mounted on a tower or not, 'be superior to one or two' ships-of-war, surely our seaport towns of second and third rate importance" (the italics are mine) "may safely rely upon open batteries on the beach to protect them from 'British' or any other 'men-of-war.'"

I make one more citation from Lieutenant Maury, that you may compare with opinions more recently expressed:

"The fortifications of the coast," says the board of army officers, whose able report of 1840 quieted the public mind, and fastened for ten years longer upon the country the effete system of 1816—"the fortifications of the 'coast,'" say they, "*must* be competent to the 'double task of interdicting the passage of ships and resisting land attacks, *two distinct and independent qualities.* The first *demands merely an array in suitable numbers, and in proper proportions, of heavy guns, covered by parapets, proof against shot and shells.*'"

"Now, I propose to show that the railroads and the means of locomotion in this country sufficiently defend our fortifications from land attacks; and that, consequently, the principal *requisite*, henceforward, in a system of fortifications for the coast, is merely an array, in suitable numbers and in proper proportions of heavy guns along the beach, to cover the approaches of ships from sea to seaport towns."

And, particularly, I call your attention to his recommendation, "that no further expenses be incurred for preparing our fortifications along the Atlantic sea-board to withstand *sieges* by *land.*"

Having given, I think, a fair view of the arguments of the objecting naval officers, I now proceed to give a few citations from Major Chase's response. As an engineer officer of rank, connected with the present system of coast defense from its initiation, his objections, or demand for modifications, deserved careful consideration.

After giving a history of the rise and progress of the present system of coast defense, referring to the experience of our late war with Great

Britain, reviewing the "new and important elements in the national defense and security which have been rapidly, almost magically, developed in the last thirty-five years—such as the increase of population, the progress of improvement in agriculture, manufactures, and commerce, and in facile lines of inter-communication"—he says:

"In view, then, of all these things, and especially of the new elements, moral, political, and physical, claimed to have been developed, and to have greatly increased the power of the United States, *and which must be considered in relation to the future arrangement of the national defense,* the undersigned thinks that the general plan, adopted thirty-five years ago, should be essentially modified, by reducing the number and size of the works proposed to be constructed, and by abandoning some of the defenses now in progress of construction, or which are about to be constructed under existing appropriations made by Congress."

"The undersigned is also of the opinion that the best interests of the country require that the subject of modification should be submitted to a board composed of artillery and engineer officers, and some eminent civilians. That no new work should be commenced, even if it has been appropriated for by Congress; and that no appropriation should be made by Congress for the completion and repairs of existing works until the whole subject of the national defense has been considered and reported by the said board."

And he further advances the opinion:

"Sufficient has been said to show that railways and the electric telegraph contribute largely to the national defense; that the works covering our large seaports and other important points, placed in connection with the railways and telegraph, if they were now to be constructed, might be much reduced in size and cost, if not in number; that the facility with which these works could be relieved in case of an attempted siege would have rendered it only necessary for them to be made secure against a *coup-de-main.*"

"Under these views of the subject it is at once perceived that, whilst the extension and invention of railways (and the electric telegraph) do not supercede, they greatly diminish the necessity of adding to the number and cost of the fortifications on the sea-board; or, in other words, that the future prosecution of the system of defense by permanent fortifications should be on a very reduced scale in comparison with the magnificent one adopted thirty-five years ago."

* * * And in relation to the influence of steam navigation of the ocean and improvements in artillery, he says: * *

"The navigation of the ocean by steam, and the application of steam to vessels of war, have certainly added to the facilities of naval operations in making attacks and transporting troops. But such operations are necessarily confined to short lines, like those between France and England, in the Mediterranean, or on the lakes between Canada and the United States."

"Attacks by steamers can only be formidable when they are numerous and filled with troops destined for a grand attack; but when they are thus filled with troops, munitions of war, provisions, armament, and their regular crews, little room is left for the fuel necessary to

propel them to the scene of action, and in retreat such steamers cannot be propelled either conveniently or rapidly until the propelling power can be produced at a less outlay for fuel. At the rate supposed to be the maximum of speed of war steamers, lines of operations over one thousand miles (five hundred in advance and five hundred in retreat) cannot be occupied advantageously, or with the efficiency necessary to a great movement of a strategic or direct attack.

"Numerous transports would be necessary to convey supplies of coal to convenient places on the coast, where depots for the same would have to be established and defended at great cost, for they would be constantly in danger of attack by sea and land from enterprising assailants. Besides, the great loads of men, munitions, armaments, provisions, and fuel that war and transport steamers would be obliged to carry, multiply the dangers of navigation."

"Certainly steamers could make sudden and brief attempts to enter harbors and destroy towns, but fast sailing ships with favorable winds could do the same, if this kind of marauding and piratical warfare was carried on by any Christian nation calling itself civilized, and if not opposed by the same machines of war as those used by the enemy, and by acts of retaliation."

"Such attempts might be successful in attack and retreat, if made in the night, even if the harbor was strongly fortified, if the fortifications were unaided by rafts and hulks lying across the channel."

"But a demonstration on a large scale against the important posts and arsenals for the purpose of taking possession and levying contributions, requires considerable land forces, even against such points as were not defended by batteries, for at such points in time of war earth erections would be made and easily supplied with cannon of heavy caliber that would do great damage, by direct and vertical cannonade, to the enemy's vessels and forces afloat after they had entered the harbor, and probably compel them to leave it and force him to select a more distant point for the initiative of attack."

"If the enemy, strong in ships and soldiers, could be driven from Boston by the erection of some redoubts in the course of one night, it is hardly to be supposed that he would attempt to recapture the position, or to attack any other position similarly situated."

"Any such demonstration at the present day would be checked by the means just enumerated, and be met on its flanks and in front by the mobile forces rallied by the telegraph to the point of attack."

"The improvement in artillery, as regards size and efficiency, has been, of late years, very great, but it inures more to the benefit of the defense than the attack. In the same way that if steam applied to ships-of-war afford any advantage to the attack, steam applied on railways, combined with the electric telegraph, affords greater advantages to the defense, by reason of the greater facility with which forces may be moved by the latter means."

"From all which it may be safely asserted that the navigation of the ocean by steam, the application of steam to vessels-of-war, and recent improvements in artillery and other military inventions, do not exhibit the attack of forts on the sea-board superior to the defense where those forts are connected with railways and are brought within

succor of the surrounding population ; nor do they render additions to the present fortifications, in number, size, or cost, in anywise necessary. But, on the contrary, the improvement in artillery, if those fortifications had now to be built, would enable their plans to be reduced *one-half* in size and the armament *one-fourth* in amount."

In what precedes, I believe I have given a fair and complete view of the "objections" to the system of coast defense as they were urged scarcely eight years ago. I do not pretend that our views of the problem of coast defense should be exactly the same that they were at that date, for I think in relation to some of our great seaports, at least, the developments of the recent war of the allies against Russia has made the problem quite a new one. But I do affirm that that war exhibited but a development, or *realization* rather, of the changes which form the basis of these criticisms of 1851. Let us, therefore, sum up these objections.

Our forts need no longer be so large. "Forts and castles" may even be dispensed with, and a few powerful guns "in open batteries" substituted. The idea of strength against land attack (or siege) is, by one critic, scouted.

"Now were it possible for an enemy, with the greatest army that ever was led into battle by the greatest captain, to take the country by surprise, and to land at Long Island, or in Lynnhaven bay, and to be disembarking his last piece of artillery before he was discovered, these railroads—the power of steam, with the aid of lightning—would enable the government, before he could reach the heights of Brooklyn, or the outskirts of Norfolk, to have there in waiting and ready to receive him, and beat him back into the sea, a force two to one greater than his, however strong."

While another thinks that "the facility with which these works could be relieved in case of an attempted siege, would have rendered it only necessary for them to be made secure against a coup-de-main," and his opinions, as to demonstrations, on a larger scale against "the important ports and arsenals" will be found in the passage already quoted.

I pass now from objections of 1851 to objections of 1858. These are found in a "letter," addressed to yourself, sir, by Lieutenant Morton, of the engineers, which has been published, and which, as it appears to have not only had much influence upon your own views but on the mind of the public, deserves more than a passing notice. They are summed up by the author in the following language:

"The first objection I offer to the existing system is with respect to the size. It adopts, even in localities where there is plenty of room,* different sorts of *masonry casemated castles* of the smallest area that will hold the number of guns required in from two to five tiers; the guns firing through embrasures in the scarp wall, which is exposed to its base, or nearly so, to the fire of flotillas. This remark applies to the sea fronts of all our sea-coast forts of importance. (Those not on this principle are small, and situated in localities where one sort of

*"As at Key West, Ship Island, Fort Point, Pensacola, the site of Fort Tompkins and Fort Richmond, at Sandy Hook, Fort Adams, and other places."

work will answer as well as another.) The works referred to have, in some cases, land fronts, that is, fronts which do not bear on the approaches of ships, or on anchorage gound. These are arranged sometimes on the bastion system, sometimes on the German, but in all cases are contracted* and weak, owing to the difficulty† of joining strong land fronts to casemated sea fronts of small development."

"The small area of these works will prevent them, in the first place, from holding any more ammunition and stores than they will need if exposed to protracted bombardment. As to a siege, those which are out of the reach of help, such as Key West, Fort Point, Ship Island, and Pensacola, will probably be short of supplies very soon, and be reduced from that cause. There will be, *in no case, the interior space* required to accommodate the magazines, &c., which must be located and protected at the points I have specified, and where the plan of fortification is still to be decided upon."

"A second disadvantage springing from this contracted area is, that there is not room enough on the terrepleins to spare for temporary bomb-proofs, traverses, &c., which are necessary to protect the barbette guns from ricochet and reverse fire and vertical fire. Also the garrison, as well as the guns, will be closely packed, and during a bombardment the chances of casualties will be increased from this cause, and from the fact that the heads of the casemate arches being open on the interior, and having a direction towards a common center, more fragments of a single shell bursting on the inside of the work will probably enter them, than if they were developed on longer lines."

"3d. Works built ont his system expose a large mark to the fire of flotillas,‡ which can hardly be missed, and a certain proportion of the entire number of shots must therefore be counted upon to enter the embrasures, carrying with them splinters of stone."

"Those shots which do not hit the embrasures will produce a certain effect in shaking the wall, and, considering the calibers and number of the guns that enter into the armament of a modern flotilla, there is reason to fear breaching."§

"It must be noted also that a small front is exposed to a more conveying fire than a large one—a point of importance according to all military authorities."

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*"Without any exception, they are smaller than a Vauban front."

†"In illustration of this see Forts Adams and Schuyler, in each of which two sides of the main work are flanked by flanking casemates in the outworks. This arrangement is certainly open to criticism; but I mention it only to show that it has been found difficult to connect the sea and land fronts; and I wish it to be understood that I do not find fault with the plan of these works, but only object to this plan being followed hereafter, now that it appears to be unsuitable to circumstances that have arisen since they were built."

‡"M. Rechild Grivel (1857) is of opinion that, considering the greater caliber and force of the sea-service guns recently adopted, and the comparative safety afforded them by floating batteries, no isolated masonry fort, however solidly constructed, can long resist an attack properly conducted."

§"It is certain that the scarps of our sea-coast works are no stronger than those of Bomarsund; brick walls of eight feet thickness, or the same backed with concrete, or granite backed with concrete, form our scarps, which are three feet thinner around each embrasure, and are in many cases not bonded to the counter forts in their rear. I do not assert that the walls of Bomarsund were breached from the water, but refer back for a comparison between large guns afloat and small ones ashore to show that a less accurate fire, provided it is from heavier guns, will effect a breach."

"4th. The use of casemates brings one tier of guns about at the level of the ground or site, and in those cases where a ditch cannot be made to surround the work (as is the case, for example, at Fort Adams, Fort Schuyler, Fort Sumter, Fort Independence, Fort Hamilton, and others) the defect results that an entrance may be effected by the enemy by surprise, or, under certain other circumstances, by these embrasures. [It appears that the southern tower at Bomarsund was entered and taken by a small party of French, who entered through the embrasures, though all the garrison had not yet retreated from it into the keep.] The iron shutters recently proposed will not entirely remove this defect, *which is inherent to small fronts.*"

"5th. The present system is carried out to advantage only on sites close to the water; and hence in many cases the advantages offered by the nature of commanding plateaus, or promontories, have been neglected, and works built at the foot of heights, even when an artificial site was necessary for the purpose."*

A system of fortifications, or of anything else which requires time and money to construct, and which, when constructed, is intended to last for years, must have more flexibility than ordinarily belongs to works of this nature, if it can meet the views of objectors who, in the brief space of seven years, on the one hand, scout the idea of *land* defense entirely or denounce our works as too strong in this particular, and, on the other, criticise these land defences as "weak and contracted."

"I do not exactly understand what Lieutenant Morton's remedy is for all these alleged evils; for though he has proposed a 'system' of 'detached bastions' connected by earthen curtains, the 'smallest application of which being a pentagon of 550 yards a side, and the largest sizes being polygons of 750 yards a side,' he himself records, without answering the objection, that the extent of ground occupied by the inclosure is too great for some of the sites which are available for the location of batteries," and moreover states expressly: "It must be recollected that I propose to fortify in this manner only certain points of the sea-coast, which I mention, and, in view of future cases, define the nature of;" and his specification and definition is as follows:

"I propose that the system sketched in the preceding discussion should be used at Key West, Ship Island, San Francisco, possibly at Pensacola,† and at other or future points of United States territory which are comprised in the following class or classes, viz: places that are fitted by nature to form bases of operations for sea warfare by being located where they may protect our own commerce, and from which that of the enemy may be annoyed; that are convenient places of retreat for repairs in safety for government ships and for privateers, or merchantmen pursued by the enemy; that can be made also safe and convenient depots for artillery, ammunition, and stores; or places that may, in addition to some or all of the above properties, be made centers of

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*"As at Fort Adams, Fort Richmond, Fort Point, and others."

†"Pensacola, if not already fortified to a certain extent, would be an admirable situation for a large work on the plan proposed; it would require a long discussion, however, to ascertain to what degree the existing works would modify the proposed new ones."

defense, from land as well as sea attacks, of territories isolated or distant from the United States."

Neither the specification nor the definition apply to more than an *exceedingly small* portion of the "sites" requiring sea-coast batteries, while the objection that he records applies to most of them. If, therefore, the objections made to "the different sorts of masonry casemated castles" are valid, we find no substitute in his essay; and however forcible the objections may be, until something better is proposed or invented we must be content with them; for I shall show hereafter that "masonry casemated castles" have played a great part in preserving seaports, cities, commercial and naval depots (the real objects of coast defense) from destruction; that they have fulfilled completely the purposes for which they were constructed.

Let us examine the subject a little more closely. Years ago it had passed into a proverb in France that "A gun on shore is worth a ship at sea,"* and the French "Aide-me-moire d'artillerie" expresses the same idea; in other words, "That a battery of four pieces of large caliber, well placed and served, ought to get the better (avoir raison) of a ship of 120 guns."

But the question which of the two will "get the better" in a direct contest, is a very different one from that which concerns the mere rapid passage of a ship or steamer through a channel defended by a battery; and it is, I think, in overlooking, in a measure, this important distinction, that Lieutenant Maury and many others, arguing from the surprising results of certain well known contests between very small open batteries and ships, have proposed, instead of stone batteries, "one or more heavy guns planted in open battery along the beach."

Even if it were admitted that the fire of a gun in an "open battery" was necessarily so much more effective (which I greatly doubt) than that of one in a casemate, it may be remarked that as (in the present state of artillery) it is, at best, but one out of a great many shots that touches a ship in a vital part, or sets her on fire, a few guns cannot be expected to prevent the *passage* of a fleet, nor even of single vessels.

I have said already that no battery or system of batteries has yet been invented which shall seal hermetically a channel (like the Narrows, for instance,) the passage of which offers to an enterprising enemy an object of sufficient importance to induce him to make the attempt at all hazards.

What, then, can be done? We must, to defend *such* a passage, use only guns of the *most destructive capacities*, and we must *multiply them*, so that we can throw upon him a perfect hail-storm of fire throughout his whole path; *and we must leave no spot, either in approaching his object, or after he gets before it,* not under our fire; and even then we must in many cases call in auxillary aid.

Again, with regard to the open battery. This peculiar efficiency which Lieutenant Maury attributes to it does not belong to it *at all*, except in *certain sites* which cannot always, nor even frequently, be found.

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*"Un cannon a terre vaut un vaisseau ā la mer."

Commander Dahlgren says: "So far, therefore, as casemated batteries are concerned, shells have added very little to the power of ships; but against guns *en barbette* they will be found of material assistance, especially if charged with balls and used as shrapnel. And against open works the concentration afforded by the well served broadsides of one or more ships should suffice to silence the works if the vessels have no unusual disadvantages to encounter, and are brought within sure distance."

And again, in his very interesting and able remarks on the "*Incidents of the War*," at the conclusion of his work, "SHELLS AND SHELL-GUNS:"

"The fire of a small barbette, or uncovered work, can always be kept under by the rifled musket and shrapnel, judiciously posted, taking the advantage of such shelter as the locality affords, or using pits for the sharpshooters, if necessary. The broadside can then be brought to bear, or the men sent ashore in force to assault. Circumstances may even admit of the landing one or two cannon to breach the work."

"The unqualified assumption that a tower or small redoubt, with its two or three guns, can of itself make good the defense against a heavy ship would naturally suggest more than is contemplated; for in that case why resort to the cost of extensive works to defend a harbor when a few towers might fully answer the purpose? But the fact is, that the advantage of site which is required to give effect to this species of defense *is rarely to be found where it is needed.** It existed neither at Cronstadt nor at Sweaborg; and at Sebastopol the elevated works of this nature only served to command the position for attack on Fort Constantine from seaward. Of themselves they could not have prevented the entrance of a single vessel into the port, nor have inflicted any material damage on an enemy making the attempt."

"Again, it frequently happens that the works are too limited in extent, or isolated and not capable of mutual support; the masonry may be bad, the site low, and *the guns unprotected by casemates;* the ordnance of inefficient power, and not commanding all accessible positions; the garrison inadequate in numbers or quality. In such cases the ship cannot fail to have the advantage, and it only remains to use it by attacking, in proper force, rapidly and energetically, concentrating the full fire of the line, at decisive distances, upon the unguarded or weak points, and affording no opportunity for improving the state of the works. Under this head may be classed those actions where ships have been eminently successful—Algiers, Acre, Vera Cruz, Kinburn, Petropolski, &c., &c."

Even if the "advantages of site" existed, a small number of guns would not always answer the purpose. The whole front of the public lands on Staten Island, at the Narrows, is (or will be) girdled by open earthen batteries, but *it is not enough;* nor would I trust these open batteries *alone* if they could contain guns enough.

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*The italics are mine.

Grivel* (who is quoted as entertaining the opinion that "no isolated masonry fort, however solidly constructed, can long resist an attack properly conducted,") uses the following language: "We could, then," (he refers to the case in which the site is low, and ships can approach near,) "if we feared being commanded or taken in enfilade by the fires of ships, substitute for earthen batteries works *in masonry, casemated, and with several stories of covered fires.*" (The italics are mine.) "This kind of fortification will expose, it is true, its 'personnel' to the chance of embrasure shot, or to wounds from stone fragments," (as if any warlike structure had yet been invented in which there was *no danger*,) "and its material to that of a breach; but these inconveniences will be in part compensated by the *assured protection*, to the greater part of its artillery, from the plunging or enfilading fires of ships." An "assured protection to the greater part of its artillery" is certainly a great object attained by "this kind of fortification," and it doubtless would be able longer "to resist an attack properly conducted" than a work which, like Kinburn, had no such assured protection.

Let me now allude to objections applying particularly to this kind of works, (*i. e.* "masonry-casemated" batteries.) And first, as to the liability to *breaching* here hinted at by Grivel, and urged again by Lieutenant Morton, who refers to Grivel's authority and opinions. There is not one single fact on record deduced from the numerous attacks of the allies on Russian "casemated castles," (and they presented them to the allied fleets almost everywhere, and with all that constitutes the "objections" to this class of works, in their most glaring form,) nor in the history of any other maritime attacks on fortifications, to justify this fear. The only event of the war which gives any *apparent* ground for it is the attack on Kinburn.

To draw any conclusion from this affair it is necessary to understand the character of the *works* which had to oppose the tremendous armament arrayed against them. Grivel's account of them conveys a very erroneous impression. He says: "The citadel of Kinburn, built upon a tongue of sand, could be ranked in the category of those masonry-casemated works for which the Russians seem to manifest a preference for the defense of insular positions, or of low sites. This fort, armed upon all its faces, offered an incomplete tier of covered fires, surmounted by a long barbette battery with earthen parapets. Its armament amounted to more than sixty guns, (bouches, a few,) of which about half bore upon the open sea. Two new batteries, armed, one with ten, the other with eleven pieces, and covered with sand parapets, were located beyond, on the extreme point, and completed, in concert with those of the other shore, the defense of the pass of Otchakon."

One would imagine from this that we had here a very perfect specimen of Russian works, and of sea-coast defenses generally; that the "masonry-casemated works" were such as set at defiance, before Cronstadt, the united maritime power of France and England.

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*"La marine dans l'attaque des fortifications, et le bombardement des villes du littoral," par M. Richild Grivel, lieutenant de vaisseau; Paris, 1856. His "opinion" is worth as much as any other individual's, perhaps. We shall see hereafter on what grounds such an opinion is founded.

Lieutenant Morton appears to draw his account of Kinburn entirely from Grivel, but adds, however, quite gratuitously, "a certain proposition of *sixty-pounder guns* to the armament of those supposed formidable works.

Having arranged his works, Grivel disposes of them as follows: "The contest had lasted but *four* hours, and during this short space of time the combined fires of our cannon of great penetration, of our mortars, had sufficed to put the place out of condition, (hors d'état,) to resist longer. Represent to yourself all its cannon dismounted, practicable breaches in the sea-front, all its edifices burnt or in ruins! in a word, the front of the Kinburn was, after the picturesque expression of our sailors, *capsized*, (*chaviré de fond en comble*,) and if its entire garrison was not buried under this complete disaster of the defenses, (son materiel,) it is because the soldiers not employed at the pieces had been sheltered in the casemates, of which a portion, resisting our bombs, had remained intact."

So the men in the "casemates" fared rather better than those serving barbette guns, (*open batteries*,) with which our modern critics are so exclusively in love; and had there been *gun-casemates* well arranged and well constructed, it is likely that the *comparative* security would have been about the same.

But let us contrast this imposing account of the works and somewhat terrific exposition of *the result with the actual facts*.*

Dahlgren, drawing his information from "official accounts by English and French admirals," describes the works and their location as follows:

"The Boug and the Dneiper issue into a large basin, formed partly by the projection of the main shore, partly by a long narrow strip of sand beach, which continues from it and takes a northwesterly direction until it passes the promontory of Otchakor, where it terminates and from which it is separated by the channel whereby the waters of the Estuary empty into the Black sea."

"The distance between the spit, or extremity of this tongue, and the point of Otchakor, on the main shore opposite, is about two miles; but the water is too shoal to admit of the passage of large vessels-of-war, except in the narrow channel that runs nearest to the spit and its northern shore. Here, therefore, are placed the works designed to command the entrance. They are three in number. Near the extreme point of the spit is a covered battery, built of logs, which are filled in and overlaid with sand, pierced for eighteen guns, but mounting only ten."

"Advancing further along the beach is a circular redoubt, connected with the spit battery by a covered way. This work, built of stone and revetted with turf, is open, and said to be the most substantial of the three; it has eleven cannon, and within is a furnace for heating shot.

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*The author of Chambers' Pictorial History of the Russian War says of Kinburn: "The fort at that place had been so little attended to by the Russians that an English lieutenant had sometime previously offered to seize and blow it up, if he had 300 men to aid him; but when the Russians saw the English steamers cruising about they began to strengthen the fort and augment the garrison, &c., &c."

"Further on, and where the beach has widened considerably, is Fort Kinburn, a square bastioned work, extending to the sea on the south, and to the waters of the Estuary on the north. It is casemated in part, though but few of these embrasures were armed, its chief force being in the pieces *en barbette* and some nine or ten mortars. The masonry, though solid, is represented by an eye witness not to be bomb-proof, and so dilapidated by age that the mortar was falling out from the interstices, leaving the stone to disintegrate. The interior space was occupied by ranges of wooden buildings, slightly constructed and plastered over."

"This fort is said to be armed with 60 pieces. The English admiral states that all three of the works mounted 81 guns and mortars. The calibers are not given officially, but stated in private letters to be 18-pounders and 32-pounders."

The above description will, I think, quite justify the further remark as to these works. "They were inferior in every respect, and manifestly incapable of withstanding any serious operation by sea or land. The main fort was particularly weak in design and dilapidated; all of them were indifferently armed and garrisoned."

So much for the works. As to the character of the armament* brought to the assault, the same authority says: "The allied force was admirably adapted to the operation, embracing every description of vessel from the largest to the smallest, and all propelled by steam. There were screw-liners, and like vessels of inferior class, side-wheel steamers, screw gun-boats, floating batteries, mortar vessels, &c., each armed in what is considered the most approved manner." And this truly formidable force carried, *besides*, "some thousands troops" on board, all designed to attack these "dilapidated" works of Kinburn.

Without going into the particulars, I will simply give Dahlgren's summary account of the affair.

"The French floating batteries (Devastation, Love, and Tonnante) steamed in to make their first essay, anchoring some 600 or 700 yards off the SE. bastion of Fort Kinburn, and at 9.20 opened a fire, supported by the mortar vessels, of which six were English; by the gun-boats, five French and six English; and by the steamer Odin, sixteen."

"The heavy metal of the floating batteries (said to be twelve 50-pounders, on the broadside of each) soon told on the walls of the fort, and the vertical fire was so good that the French admiral attributed to it, in great part, the speedy surrender of the place. The gun-boats also made good ricochet practice, which was noticed to be severe on the barbette batteries."

"The Russian gunners in nowise daunted by this varied fire, plied their guns rapidly in return, directing their attention chiefly to the floating batteries which were nearest."

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*I find no detailed statement of the total number of vessels, guns, troops, &c., of the allied force. The Pictorial History gives the following as the English quota, viz: "6 steam line-of-battle ships, 17 steam frigates and sloops, 10 gun-boats, 6 mortar vessels, 3 steam tenders, and 10 transports, making 52 vessels, carrying in all about 1,500 guns and 5,000 troops of all kinds." The French force is not stated; but there were four ships-of-the-line, a number of steam vessels and gun-boats, besides the three famous floating batteries, (here first employed,) and a considerable body of troops. The troops of both nations were landed previous to the naval attack, and the place invested by land.

"Exactly at noon, the admirals steamed in with the Royal Albert 121, Algiers 91, Agamemnon 90, and Princess Royal 90, with the four French liners in close order, taking position in a line ranging NW. and SE., about one mile from the fort, in 28 feet water."

"At the same time a squadron of steam frigates* under Rear-Admirals Stewart and Pellion, dashed in through the passage to the basin, opening fire on the spit and central batteries in passing and anchoring well inside of Fort Nicholaier and Otchakov. The attack seaward was completed by the Acre 100, Curaçoa 30, Tribune 30, and Sphynx 6, opening on the central battery, while the Hannibal 91, Dauntless 24, and Terrible 21, assailed that on the spit. To this storm of shot and shells the Russians could not long reply. In the spit battery, the sand falling through between the logs, displaced by the shot and shells, choked the embrasures, and blocked up the guns. In the fort the light wooden buildings were in flames at an early hour, then the walls began to crumble before the balls, which came from every quarter, front, flank, and rear; and as the guns were disabled successively, the return became feeble, until few were in a condition to be fired, the central redoubt alone discharging single guns at long intervals. The Russian commander, however, made no sign of surrender; but the admirals seeing that his fire had ceased, and further defense was unavailing, hoisted the white flag at 1.35 p. m., upon which the works were given up on honorable terms."

"The garrison consisted of about 1,400 men; their loss is differently stated; the French admiral says 80 wounded; another 43 killed, and 114 wounded."

"The English suffered the least, having but two men wounded, besides two killed and two wounded in the Arrow, by the bursting of her two 68-pounder Lancaster guns."

"The superiority of the allied vessels in number and caliber of ordnance was very decided; they must have had 650 pieces in play, chiefly 32-pounders, and 8-inch shell-guns, with a fair proportion of 68-pounders and mortars, besides the 50-pounders of the French floating batteries. To which the Russians could only reply with 81 cannon and mortars, and no guns of heavier caliber than 32-pounders, while many were lower. The great disparity in offensive power was not compensated to the works by the advantage of commanding position; the Russian fort and redoubt being upon nearly the same level with the ships' batteries, and also very deficient in proper strength. On the other hand, the depth of water did not allow the liners to approach nearer than one mile, and thus, then, fire was by no means so intense as it would have been at shorter range."

"This was the sole occasion in which the floating batteries had an opportunity of proving their endurance, which was the question of most importance, as no one could doubt the effect of long 50-pounders or 68-pounders, when brought within a few hundred yards of masonry, and able to retain the steadiness indispensable to a breaching fire."

"No siege operation had ever embraced batteries of such power, for

*"Valorous, 76; Furious, 76; Sidon, 22; Leopard, 12; Gladiator, 4; Firebrand, 6; Stromboli, 6; Spiteful, 6; Asmodée, Caaquet, and Lane."

though the English had employed long 68-pounders at Sebastopol, yet the distance from the objects exceeded a thousand yards, and the concentration of fire, so far as any opinion can be formed from the published statements, was far inferior to that of the 36 50-pounders in the broadsides of the three batteries anchored in close order.

They were hulled repeatedly by shot—one of them, (the Devastation,) it is said, 67 times without any other effect on the stout iron plates than to dent them, at the most one and a half inch—still there were 10 men killed and wounded in this battery by shot and shell which entered the ports—and the majority of damage to the French personnel (27 men) occurred in the three floating batteries."

The affair proves *nothing*—unless it be that "dilapilated" and ill-designed and ill-constructed works, armed with inferior calibers, cannot contend against such an overwhelming array of force as was here displayed. But the failure to derive from it any conclusion against "masonry casemated" works—or "castles" is the more signal, owing to the very important fact that it was *mainly* a contest of "open" or "barbette" batteries, whose superiority over casemated ones has been so much insisted upon.

In this account we hear nothing of "practicable breaches," though *doubtless* 36 50-pounders at 500 yards would "*tell*" on the walls of such a fort. Yet as the "vertical fire was so good that the French admiral attributed to it, in great part, the speedy surrender of the place"—while the "ricochet practice" from the "gunboats was seven" upon these low open batteries, while the "edifices" behind them (old wooden buildings "slightly constructed and plastered over") were in a blaze which must have made, by heat and smoke, the service of the guns almost impracticable—there is no difficulty in accounting for the result of the contest.

Whether or not a "practicable breach" was made is of little consequence in such a case; but turned upside down as (according to Grivel) the defenses were, with the garrison nearly buried in the "ruins," it appears there were only 157 (out of 1,400) killed and wounded—a very small loss, under all the circumstances.

The fact is, that these open batteries "were turned upside down," the guns disabled and dismounted by the deluge of direct, vertical, and ricochet fire poured upon them, as in all "open batteries," in such situations, *ever will happen.**

I have given much space to this affair of Kinburn, for Grivel parades

* According to the "Pictorial History," the Russian artillerymen at these "open batteries" were exposed *besides* to the fire of *sharp-shooters*. It says: "Bazine" (the general commanding the French troops) "placed two companies of chasseurs under cover, at a distance of 400 yards from the east side of the fort, and kept up a fusilade on the Russian artillerymen."

As to the armament, the same author says: "The captors found nearly 80 guns mounted in the fort and batteries, mostly long and heavy 18-pounders and 24-pounders; but there were many others ready for mounting, platforms to support them, and newly constructed casemates, raising the total of guns to 174."

Notwithstanding that the fort was (according to Grivel) "capsized," (chariē,) and the garrison nearly "buried in the ruins," it does not appear that they were fully sensible of their condition. The "Pictorial History" says: "The officers in general bore the scene" (the surrender) "with dignity, but with deep mortification; and many of them were said to be on the verge of mutiny against the governor, so strongly did they resist any proposals for surrender."

it as a fair illustration of what floating batteries, combined bomb-vessels, gun-boats, &c., can do against "masonry casemated" works. I have shown how inaccurate (by comparison with the official accounts) is Grivel's account of the affair, and I have further shown that *no conclusion whatever* can be drawn from this contest of insignificant works, armed with low calibers, against such an overwhelming means of attack as were here arrayed, unless, indeed, it be this, (a fact before well known,) that for *low sites*, *open batteries* are the most inefficient of all. The fort of Kinburn surrendered, *not because* it was breached, not because its defenses were so far diminished by their losses as to be unable to protract the contest, but simply because the guns and gunners, exposed in all possible ways, were put *hors de combat*, and the calibers were incapable of doing any great damage to the vessels at the distance they were stationed.

With regard to the effects and endurance of the much vaunted *floating batteries*, first used at this attack, Lieutenant Dahlgren very judiciously remarks:

"The use that can be made of floating batteries as auxiliaries in attacking shore works must depend on further confirmation of their asserted invulnerability. It may be that the performance at Kinburn answered the expectations of the French Emperor as regards offensive power, for that is a mere question of the battering capacity of the heaviest calibers, which is undoubted; but the main issue which concerns their endurance cannot be settled by the impact of 32-pounder shot fired at 600 and 700 yards. Far heavier projectiles will in future be found on all sea-board fortifications; and the ingenuity of the artillerist may also be exerted more successfully than at Kinburn. Still, it is not to be doubted that the floating battery is a formidable element in assailing forts, even if its endurance falls short of absolute invulnerability, and the defense will do well to provide against its possible employment."

Experiments in England have shown that such vessels, protected by wrought iron plates 4½ inches thick, were incapable of resisting a solid 68-pounder shot at 400 yards.*

Such shot, and even greater, they will certainly have to resist if they are to contend with the modern armament of our fortifications. Grivel sagely cautions them to take position at *such a distance* that they cannot be penetrated. The only possibility, however, of breaching a well constructed masonry revetment consists in placing the battery at *very short distance*. The difficulty of breaching increases enormously even in land batteries with increase of distance; far more in floating batteries, owing to the unavoidable motion of the vessel, which at considerable distances scatters the projectiles far and wide.†

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*Experiments made at Woolwich to test the resistance of the sides of the batteries constructed during the late war. "The target was an immense construction of timber and iron combined, exactly like the sides of the batteries, iron 4½ inches thick. Twenty-four rounds of 68-pounders were fired, the first fourteen of which at six hundred yards, and after the first few rounds the timber work gave way in all directions; the last ten rounds at four hundred yards, and the work of destruction was complete. The last shot fired went completely through the target, timber and iron included."—(*The Engineers and Architects' Journal, Jan.*, 1858.)

†The idea that a floating structure can be made shot-proof, while the walls of a fort *cannot* be, is so transparently absurd as scarcely to require refutation. All that will be maintained,

The works at Bomarsund were taken by means of *land batteries*, which breached the exposed walls of the towers and main work. There is no more stringent rule of fortification than that which demands that all masonry shall be *covered* (by earth works or otherwise) from the action of land batteries, where the circumstances of the location render their use practicable. The Russians disregarded this rule in the arrangement of their works at Bomarsund, and to that disregard owed the prompt reduction of the place. The masonry was faced with blocks of granite of very irregular shape backed by rubble. I doubt very much whether Lieutenant Morton's assertion is tenable, that "it is certain that the scarp of our sea-coast works are no stronger than those of Bomarsund."*

Concerning the action of the *land batteries*, Sir H. Douglas says: "Authentic information, for the accuracy of which the author vouches, enables him to state that with respect to the effects of the solid shot on the granite, with which the walls were faced, the French guns made no impression on the blocks when they were struck perpendicularly in the middle of their faces; nor did the shot fired from the more powerful 32-pounder British guns, split the granite when so struck; but when the blocks were hit by the latter near the edge or on a joint of the masonry, they were displaced, the joints penetrated, the wall shaken; and this not being backed with solid masonry, but filled in with rubble, the mass was thrown down and a practicable breach formed. This successful operation is very generally but erroneously stated to have been effected by the fire of the ships, and is even strongly held up as a proof what ships can do, and ought to attempt, alone elsewhere."

The large joints which the *rubble* facing of Bomarsund offered, facilitated greatly the action of batteries. Such joints are not found in our scarps, exposed to vessels' fire, nor in general are such walls (where casemated and pierced for guns) "backed with concrete."

But the *experimental practice* of the "*Edinburgh*" upon the walls of Bomarsund (after the capture) deserves to be recorded, for here, if ever, with all the means and no hostile shot to encounter, a ship's batteries might be expected to breach granite walls." The "Edinburgh" had, in this case, all the *essential qualities* of a floating battery, viz: "the largest and most powerful guns in the British navy." Shot-proof sides would not have added to her *offensive powers*.

I give Sir Thomas Douglas' own words: "But the results of the experimental firing at the remnant of the fort which, unless the previous firing of the ships during the attack was absolutely harmless, must have been somewhat damaged and moreover shaken by the blowing up of the contiguous portions, do not warrant this conclusion; even should the attacking ships be permitted, like the "Edinburgh," to take up, quietly and coolly, positions within 500 yards, and then deliberately commence and continue their firing without being fired at! The firing of the "Edinburgh," at 1,060 yards, was unsatisfactory. Three hundred and ninety shot and shells were fired from the largest

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probably, will be that, in general, the latter are not shot-proof. I shall allude to this subject again.

*See Appendix "A."

and most powerful guns in the British navy, (viz: from the Lancaster gun of 95 cwt. with an elongated shell of 100 pounds; from 68-pounders of 95 cwt. and 32-pounders of 56 cwt. solid-shot guns; from 10-inch shell guns of 84 cwt. with hollow shot of 84 pounds; from 8-inch shell guns of 65 and 60 cwt. with hollow shot of 56 pounds,) but did little injury to the work. At 480 yards, 250 shot shells and hollow shot were fired; a small breach was formed in the facing of the outer wall, of extremely bad masonry, and considerable damage done to the embrasures and other portions of the wall; but no decisive result was obtained—no practicable breach formed by which the work might be assaulted, taken, and effectually destroyed, although 640 shot and shells (40,000 pounds of metal) were fired into the place, first at 1,060 and then at 480 yards."

Truly, if floating batteries can do no better than this when they have it "all their own way," I think we need not be in very great apprehension for (even) our "isolated forts," which Grivel seems to think (and Lieutenant Morton quotes his opinion) "cannot long resist an attack properly conducted, *however solidly constructed they may be.*" (The italics are mine.)

The harbor defenses of Sebastopol were very fair specimens of Russian "masonry-casemated" works, and are types of the same class of works built in this country, though the material of which they were built was very inferior, and they were in many *very* important details, (as I shall show hereafter,) particularly *embrasures*, vastly inferior to our oldest specimens, and not to be compared at all with those built by us in the last few years. The "naval cannonade" of these works, on the 17th of October, 1854, might be expected to throw some light upon the relative powers and liabilities to injury of the two characters of armament here opposed. But such is not the case. The Russian works were not armed with the powerful sea-coast guns now deemed essential; and, on the other hand, the allied fleet was *nothing but a fleet*—i. e. it was not furnished with those *special* means of attack (gun-boats, mortar vessels, floating batteries, &c.) which will always *hereafter* be provided for such attacks. It was, therefore, an *old fashioned affair*, and might rather be set down as the *last attempt to array ships-of-the-line and ordinary vessels-of-war against fortifications.*" This question has long been practically (though not confessedly, perhaps) settled. It was settled before our Mexican war, when, for near a whole year, our fleets threatened San Juan de Uloa, yet never ventured to measure their strength with it, notwithstanding they had the precedent of the quite recent much vaunted French triumph over *this very work*. It was practically settled throughout his whole European war, in which the powerful allied fleets (the *most* powerful naval armaments the world had ever seen) threatened in turn all the strongholds of Russia on the Baltic, and, notwithstanding that public opinion at home, and naval pride in the fleet, demanded some exploit which should be commensurate with the immense preparations made, retired abashed and confounded before the "masonry-casemated castles," whose "crockery" walls did not, after all, seem to invite a close contact or "hard knocks," and which so proudly fulfilled their mission

in protecting, throughout that war, the military and naval depots, the wealth, the commerce, and the *national honor* of Russia.

Sweaborg, indeed, suffered, but it was from a distant bombardment, which left her fortifications and her harbor intact, and only showed the necessity of protecting at greater distance all great *depots* or great cities.

Bomarsund—alas for Bomarsund! or, rather, for the prestige of the mighty naval armament which would have assaulted it.

One single masonry "casemated castle"* bid defiance to the proud armament, whose chiefs, concluding wisely that "discretion was the better part of valor," sent home for 10,000 French troops, who, with a few 76 and 32-pounder guns in land batteries, speedily reduced the work.

The "naval cannonade" at Sebastopol was a mere "simulacre" of an operation of which the inutility was felt, and from which no other results were expected than a diversion of the attention and strength of the garrison from the land side, where a real struggle for predominance was going on between the artillery fires of besieged and besiegers.

The allied fleet consisted of fourteen French, ten British, and two Turkish ships-of-the-line, (some few of which had auxiliary steam power,) and a number of side-wheel steamers to tow these, and carried in all about 2,500 guns. It was opposed by about 280 guns from the works. The fleet kept itself, in general, at a respectable distance—from 1,500 to 2,000 yards—too far to inflict any material injury with its armament (32-pounders, with a moderate proportion of 8-inch shell guns) upon the works—too far to receive much from the inefficient armament of those works.

The only exception to this remark applies to the detached English squadron under Sir Edmund Lyons, consisting of the Agamemnon, Sanspareil, London, Arethusa, and Albion, the first-named of which vessels took a position at 750 or 800 yards from Fort Constantine, while the others stretched along at about the same distance, from Fort Constantine, the "Wasp Tower," and "Telegraph Battery." Dahlgren describes the result as follows:

"The Agamemnon was very seriously maltreated, though not to such an extent as to impair her power of battery or engine. She was on fire several times; was struck by 240 shots and shells; and singular to say, only lost 29 men, while her second, just by, lost 70 men. The Albion suffered still more, and in an hour was towed out crippled and on fire in more than one place, with a loss of 81 men. The crews of the London and Arethusa fared rather better; but the ships nearly as ill, and they too remained in station but a little time after the Albion. The Queen was driven off soon after she got into her new position in great danger; and the Rodney had the bare satisfaction of getting around and afloat after experiencing some damage."

"The value of the small works on the cape and bluffs was clearly

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* It is worthy of remark in this place, that this "casemated castle" (like *very many* of the Russian batteries of the same character) *had nothing but casemate guns.* There was not (as is *invariably the case* with our works) an "open battery" (barbette) on the top, the upper tier of arches being simply made bomb proof by earth and roofed over.

defined in these results; being above the dense cloud of smoke that enveloped the ships and the lower forts, their aim was not embarrassed, while the seamen labored under the difficulty of firing with an inconvenient elevation at objects that they saw but seldom, and then but dimly and briefly. As a consequence, three line-of-battle-ships and a frigate were driven off very shortly, and in great peril, and a fourth badly cut up; while the Agamemnon lay opposed to one of the heaviest sea-forts with two tiers of casemates, and at the end of five hours came off with comparatively little loss."

Whatever superiority of effect the batteries on the heights may have had, (and we have so few details about these works that we can draw no sure conclusion from this mere naked statement of damages received by the vessels,) it evidently was not for want of being *hit* often enough (smoke or no smoke) that the Agamemnon escaped with so little injury. She was "struck by 240 shots and shells," and it is only due to the inefficiency of the projectiles by which she was struck that she was not destroyed.

With respect to the damages received by Fort Constantine, I quote again from Dahlgren at length.

"The distance of the Agamemnon and Sanspareil from Fort Constantine, (17th October, 1854,) was assumed to be about 800 yards; Lord Raglan states it to have been rather less. These two ships could bring to bear about 87 guns, and the firing from them probably lasted some four hours. There can be no doubt that it inflicted much damage, for the Russian commander-in-chief admits it in his official report; but not sufficient to impair the strength of the masonry, and far short of effecting a breach in it."

"At Bomarsund the results were rather different. Three 32-pounders of 42 cwt. (guns of inferior weight) were landed from a ship's spar-deck and placed in battery at 950 yards from the north tower—the masonry of good quality and 6½ feet thick. In eight hours the wall between two embrasures was cut through from top to bottom, offering a practicable breach, to effect which 487 shots and 45 shells were fired,* being at the rate of one round from the battery in rather less than a minute, or, from each gun, one in 2¾ minutes. The tower surrendered."

"It seems almost incredible that three pieces should be able to accomplish fully that which eighty-seven pieces utterly failed to do, the distances from the objects being alike; particularly when it is considered that many of the latter were of greater caliber, and most of them employed much heavier charges when the calibers were similar. The guns of the ships, if fired at the same rate as those of the battery, which was not unusually rapid, (one round in 2¾ minutes,) would have discharged some 7,700 shot and shells in the course of the four hours, supposing no interruption; a number of which, if properly applied, would appear from the results of the three guns to have been sufficient to breach the wall of the fort in fourteen places; whereas, they did not effect a single breach, which is abundant proof of the lack of accuracy. They must have either been dispersed over the surface

* Report of General Neil, commanding engineers.

of the fort, or else missed it altogether; and this could have been due only to a want of the precision which was attained by the battery. The constantly preferred complaint of motion in the ships was not to be urged, because on the day of cannonading Sebastopol there was scarcely a breath of wind, and the ships were too large to be easily moved by the swell, unless very considerable. That the fort did no greater damage to the ships than it received from them, proves no more than that its fire was quite as illy directed, and the calibers too low. It is said that the Agamemnon was struck in the hull by 240 shot and shells, which must have been but a small portion of what were fired, though sufficient to be decisive, if, as already observed, the caliber had been heavier."

A number of projectiles sufficient to produce 14 "practicable breeches," if thrown by a land battery, here failed not only to produce a single breach, but even to "impair the strength of the masonry."

Lieutenant Dahlgren, indeed, deprecates the "want of precision;" but that degree of precision by which a breach is effected by a land battery is utterly unattainable from a floating structure; and the perfect calm which prevailed on this occasion cannot be counted on in general; and even the *swell* in the calmest days is quite sufficient to disperse the projectiles from a floating battery at 400 or 500 yards far and wide.*

I have said that, as to the contest of *ordinary naval means*, or fleets, with fortifications, the question has long since been practically settled.

The following extract from Grivel will show how the matter is regarded even by those who believe that fortifications *may* be *successfully* attacked by naval means specially adapted to the object.

"If the coast defenses are at the same level, or can be *commanded* by the floating artillery; if the depth of water permits to combat them separately, and to approach at half point-blank distance, (that is 300 or 400 meters,) we would still say to ships, however well armed we suppose them, *never attack without an imperious and absolute necessity.*" But if these works occupy positions which command the sea while they reciprocally sustain each other; if sub-marine obstacles or other causes oblige the floating artillery to maintain a greater distance, we do not hesitate to say to ships, "'*Keep off, the match is too unequal, but bring up your siege floating batteries;*' for then will be the time to substitute these formidable machines of war, and then artillery of the greatest penetration, for the vulnerable sides and guns of less range of ordinary vessels." Even in the most favorable case he can describe, he says to ships, "Attack not without an imperious and absolute necessity."

The question of direct contest for superiority between forts and naval armaments will be narrowed down to this: if forts are to protect the channel (as they *usually* are) through which a fleet must pass to reach our ports and cities, or naval and military depots, the fleet will

*Lieutenant Dahlgren commends the "'Nelsonian vigor' of this spirited and brilliant episode enacted by the detached squadron." With all deference to so competent a judge, I cannot help remarking that if there was "Nelsonian vigor" there was no "Nelsonian" result. The trifling damage done to the fort was a poor compensation for the loss of over 200 men, and the serious injuries all the vessels of this detached squadron received.

either *run by,* or, if the works are too formidable, decline contest altogether; but *if the object is sufficient to justify the preparation, (the great port and city of New York for instance,)* and the defenses are such as to invite the effect, the maritime enemy will provide those "formidable machines of war" and enter into *a direct contest with them,* with a view to their reduction, or to extinguishing their fire.

I am now considering the latter branch of this subject, and think that I have made it clear that, so far as we have yet any experience, there is nothing to justify the apprehension that the masonry scarps of casemated batteries can be destroyed by the cannonade of floating batteries. Of course, if such vessels are permitted, unopposed by the guns of the battery itself, to take their own time and to expend unlimited quantities of projectiles, they *doubtless can batter down any wall.* So far as yet tested by experience, their bulwarks are not proof against eight and ten-inch solid shot at 400 yards. *If* proof against such projectiles at 800 or 1,000 yards,* it is a well-known fact in breaching, that the number of the projectiles necessary, even from a land battery, increases enormously with increase of distance. How much more from a floating structure which cannot maintain any such concentration of fire at such a distance as is necessary to do serious injury to well constructed walls. Those, however, who believe in such operations, will probably contend that nothing analagous to producing a "breach" is necessary, but that embrasures will be destroyed and guns dismounted, and gunners disabled by embrasure shot and splinters from the masonry cheeks, or by fragments of broken projectiles.

This subject has not been overlooked by the corps whose duty it is to make such constructions. A series of experiments was commenced, five years ago, at West Point, by General Totten, chief engineer, and taken up again in 1855, for *this* very purpose of determining the best kind of embrasure, and the necessary thickness of the scarp to resist these modern projectiles. The results have been published† and are open to the examination of every one. They may be briefly summed up in the following quotation:

"A thickness, then, of five feet has been assumed in our constructions, and satisfies all these conditions well." (Alluding to the internal arrangement of the casemate, with reference to handling the gun, &c., &c.) But it has been a question of interest, increasing with the growing calibers of naval armaments, whether this thickness is now sufficient. And it was in consequence thereof that some very severe firing was directed against our second target. The gun was a 10-inch columbiad, placed within 114 yards, firing solid balls, weighing 128 pounds, with a charge of 18 pounds of powder."

"The general conclusion from these trials is, that, whether of

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*I think it somewhat discreditable to the inventive resources of those whose duty it is to construct and perfect artillery, that this question of a shot-proof vessel should be an open one. The quantity (and therefore the thickness) of the iron sheathing is limited for the floating battery. I know no necessary limit to the caliber or weight of the projectile used against it, or why we should now stop at ten inches when the navy has already successfully introduced an eleven-inch gun capable of throwing a solid shot. The eleven-inch solid shot weighs one-third more than the ten-inch. I shall allude to the subject of large calibers for sea-coast batteries in another place.—(*See Appendix "D."*)

†"Casemate embrasures," Totten, "being No. 6 of papers on practical engineering," published by the Engineer department.

cement or concrete, of bricks, or of hard stones, the portion of the wall at and around each embrasure, having the thickness of five feet only, should be no larger than is indispensable for the adaptation of the gun and carriage to the embrasure; if restricted to a small area, this thickness will suffice; not otherwise."

"The thickness of five feet will resist a number of these balls, impinging in succession on that space, provided the bond expand promptly above, below, and on each side into a thickness greater by some two and a half feet or three feet or more. Were the wall no thicker, generally, than five feet, being reinforced only by piers some fifteen feet apart, it would soon be seriously damaged by battering at short distances with such calibers."

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"To repeat: the scarp at the embrasure may be safely made of the thickness of five feet, provided the thickness immediately above, below, and on the sides be increased considerably. The space required to be of about this thickness to accommodate advantageously the gun and carriage is so small that it may be said to be part of the thicker surrounding mass by which it really is supported in its resistance."

And with regard to the embrasure it is stated: "Our experiments show that wrought iron is the best material for insertion as above mentioned, and that a thickness of eight inches of wrought iron, solidly backed with masonry, will resist an 8-inch solid ball fired with $10\frac{1}{4}$ pounds of powder from a distance of 200 yards. It is necessary, as is also shown by the firings, that the plates of iron should have considerable breadth to prevent heavy balls from forcing themselves in between the inner edge and the masonry, thereby crowding the plate edgewise into the throat."

From these results an embrasure has been devised by the chief engineer, and sanctioned by the War Department, having wrought iron throat plates eight inches thick, (capable of resisting the impact of an 8-inch solid shot from 200 yards distance,) and the whole surrounding structure of granite blocks of large dimensions, bonded together and into the adjacent thick part of the wall, in the strongest manner that such a structure can be made. Those who deny the capability of such a construction to resist *sufficiently* the projectiles of an hostile armament should at least *prove* that their incredulity is justifiable by experiments as elaborate as those I have referred to.

But the discussion is cut short at once by the following paragraph from the report:

"Were it not for the vastly greater cost, the whole scarp might be faced with iron—indeed, might be made of iron only; but until there shall be much stronger reasons than now exist, or are now anticipated, for believing that well-constructed masonry batteries may be breached by naval broadsides, the cheaper construction may be safely followed, especially as, should such a necessity even arise, they may be externally plated with iron."

If the necessity arises—if there shall be hereafter stronger reasons than now exist, or are now "anticipated," for giving still greater strength to the surrounding wall, the alternative is as open to us as to those who construct the floating battery, (without the objection of

weight, so very difficult to overcome in that structure,) to coat it (about the embrasure, or further, if necessary) with iron plates.

Those who are curious on the subject of "embrasures" and of the risks to which the gunners behind them are exposed, would do well to examine the work referred to. They will find, among other things, that while some of the *modern* European works present an *exterior* opening of 54 square feet, (in which area, owing to the flaring checks, nearly all small projectiles are reflected through the throat, while large ones are broken, and then fragments hurled within,) no embrasure has been constructed in the United States since 1815 having an exterior opening exceeding 10 or 11 square feet, and that the model embrasure of 1855 *pratically* reduces the opening to that of the throat, *which is but* 3 9-10 *square feet*, an object not much larger than the muzzle of a large gun. The security of the gunner behind this embrasure is as great, probably, as it is practicable to give *anywhere**—it is probably *greater* than in any open barbette battery.

The question of the capacity, actual and possible, of "masonry casemated castles" to resist the fire of a hostile armament need not be pursued further. When we bear in mind that the hostile "floating batteries" of whatever description will themselves be exposed to the most formidable projectiles that can be thrown from shore batteries, that when they choose to come to "close quarters" to attempt to breach, *their* embrasures present openings† through which deluges of grape, canister, and musket-balls can be poured upon the gunners;‡ and considering what experience has so far shown us, and reason has taught us with regard to the casemate, we need not be apprehensive that our casemated works will be battered down, nor doubt that they will, as they did in Russia, answer the important purposes for which they were designed.

It only remains to show the *necessity* of such works. It in general costs much less to place a gun behind an earthen parapet than to build a masonry structure covered with bomb-proof arches in which to mount it.‖ All authors agree that an open barbette battery (Grivel's very forcible admission has been quoted) on a low site, and to which vessels can approach within 300 or 400 yards, is utterly inadmissible. It may safely be said that in nine cases out of ten the sites which furnish the

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*A simple expedient advocated by one of our officers, and partially practiced in Europe, to raise the embrasure so that all embrasure shot would pass over the heads of the gunners, (as in the barbette battery,) would in a great degree do away with the danger of "embrasure shot" of all kinds, and with the necessity of grape-proof shutters applied to the new embrasure.

†See paper No. 6, on practical engineering, before referred to.

‡Grivel seems to think that, as to embrasure shot, the floating and land battery are on equal terms; but the embrasure of the floating structure cannot be made as small as that of the casemate, nor can the expedients of "shutters" or of raising the embrasure above the heads of the men be resorted to.

‖The discrepances in cost is not, however, by any means what this naked statement would make it appear. A gun behind an open parapet is exposed to being disabled or spiked by a mere boat's crew taking the battery by surprise. *Some degree* of defensive strength is necessary in all cases, and in *some* cases the necessary strength involves (independent of other causes) the construction of a regular fortification. The open earthen batteries of Lieutenant Morton rest on inclosed bastions of masonry, each of which is larger than most of our harbor works.

efficient raking and cross-fires upon the channels are exactly of this character; and, indeed, it very often happens that there are no others.*

When such sites are found it rarely happens that they afford room for sufficient number of guns in such batteries.† Hence the necessity for putting them tier upon tier, which involves, of course, the casemated structure. Such works, furnishing from their lower tier a low razing fire, and (if of several tiers) a plunging fire from the barbette, offer as favorable emplacements for guns as can be contrived, and afford to their gunners a degree of security quite as great as *can* be given to men thus engaged.‡

On subjects which have a mere speculative importance there is no danger in giving rein to speculation; but on those of such real and *intense* practical importance as the security against hostile aggression of this great city and port of New York it is not admissible to set aside the experience of the past or the opinions of the best minds who have devoted themselves to such subjects. A means of defense sanctioned by its being confided in to protect the great ports of Europe, which *has protected* the great ports of Russia against the most formidable armaments that ever floated on the ocean, has a claim upon our confidence which mere criticism cannot diminish, and a claim to be adhered to in place of all new "systems" until time and trial shall have *necessitated* (not merely justified) the change.

If, then, we refer to the practice of other nations to find what has been judged necessary for the defense of important parts—to experience to find how such systems have stood the test of actual *trial*, we may draw useful conclusions with regard to what is now required to defend New York. We shall find at Sebastopol—a narrow harbor, which owed its importance to its being the great naval depot of Russia in the Black Sea‖—an array of nearly 700 guns, about 500 of which were placed in 5′ "masonry casemated" works, (several of them of great size,) and the remainder in open batteries.§ These defensive works fulfilled

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*Take the case of Sebastopol for example, about which there *are* heights; none of them (Commander Dahlgren's remarks have been already quoted) furnish proper sites for defending the harbor. Cronstadt offered no sites whatever, other than artificial ones, in an island almost level with the water. Our own harbors generally offer the same illustration of the rarity of favorable sites for open batteries.

†Staten Island, at the Narrows, furnishes an apt illustration. The heights here are about 120 feet. From the open batteries of Fort Tompkins, on the summit, heavy guns will rake the approach, and have a plunging fire upon passing vessels. *The entire force* of the heights (so far as the United States property extends) is, or is to be, girdled with *open earth batteries* at heights of 60 and 45 feet. We have here about as many guns as *can be* ranged in such batteries, but it is not deemed enough, nor is the character of the fire such as to dispense with the numerous and close and raising fires to be obtained from the sites at the water's edge, in which Fort Richmond is already built, and there a similar "casemated castle" is *to be* built.

‡The criticism as to their capacity for men and stores is scarcely deserving of notice. When they are merely *water batteries*, (as most of them are,) they require quarters enough for men to work the guns, (five or six to each piece,) and ammunition storage enough for one or two protracted cannonades. In the mere service of the guns there is no crowding whatever.

‖An important point surely, but how small the importance and the interests involved in its defense compared with New York.

§It is worthy of remark that the only battery mentioned as silenced by the allies' fire during the cannonade of the 17th of October is that of the Quarantine Fort, an "open barbette," silenced, as Grivel says, "malgrē l'abri de son parapet en terre," (notwithstanding the shelter of its earthen parapet.)

their object, and sustained the attack of the allied fleet on the 17th October, 1854, without sensible damage.

The facility with which seaports are attacked by a fleet, compared with the enormous preparations required and the great risks encountered in landing a besieging army on the coast of a formidable enemy, (while for protection against the former species of attack costly works are necessary, and against the latter field works and men can, in emergency, afford protection,) naturally caused the Russians to make these water defenses their *first* object. Yet, though almost unprotected on the land side, Sebastopol resisted for a whole year an attack on that quarter, and illustrated how, with plenty of men and materiel, an energetic and effectual *land defense* may be improvised.*

Let Cronstadt be another example. Great as was the importance of its defense to Russia, it was not greater—it was by no means *as great*—as that of New York to our country. This port and military and naval depot was defended (on its main approach) by about 680 guns,† 500 of which were mounted in 5′ "masonry casemated" works; the remainder in an open barbette battery which enfilated the main channel. This number is formidable in itself, yet the same number mounted in New York harbor would not afford *anything like* such a formidable defense as was found at Cronstadt, owing to its great area and long line of approach compared with the latter.‡ *These works fulfilled their object.* They protected the great port and depot of Cronstadt, and the capital of the empire from invasion. For two successive years did the mighty armaments of France and England threaten, but they were overawed by the frowning array of "casemated castles" which opposed itself,* and declined the contest.

Let us turn our eyes now to the great naval depot of France. After the almost incredible expenditure lavished here in creating a harbor facing the shores of her great rival, England, and an equally profuse expenditure in providing all that constitutes a great naval depot, we may suppose that the best means, without regard to cost, which the science of war could devise would be employed here to make this great seat of naval power secure against the formidable means of attack possessed by the great maritime power most likely to be the assailant. The means there employed are, so far as regards mere *harbor* defense, precisely the same, (viz: casemated works in several tiers, combined with open batteries where the locations are favorable,) and the application of means in the same as we have found so successful in Russia; the same which constitute the system of harbor defense of New York.

Let us now consider what, in the present state of the art of war, and

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* See Appendix E.

† Besides the above number, there were about 120, constituting the broadsides of two ships anchored between Forts Menschikoff and Cronstadt.

‡ For a more detailed account of the defense of Sebastopol and Cronstadt, see Appendix B.

* A special armament was being fitted out in England *expressly* to attack Cronstadt had the war lasted another year. It consisted of several hundred "floating batteries," gun-boats, mortar vessels, &c., &c. It would have been interesting, in a professional point of view, to have seen the result; but it is quite doubtful, after all, whether the allies would have "taken the bull by the horns." They would probably have directed their attack upon the shoal water approaches between the Finland shore and the island of Cronstadt.

in the light of the experience we now have, is required for the defense of the port and city of New York.

In commencing this paper, I have ventured to say that this problem has become "a modified and enlarged one;" but the course of the previous discussion will have shown that I do not believe that we know of anything particularly *new* in the *means* to be employed; it is rather in the amount and *character* of the armaments to which New York will be exposed, which involves a new consideration of the amount and arrangement of defensive means.

In reviewing the recent European war, we are struck with the facility with which immense bodies of troops were transported to and maintained in a distant country which of itself furnished nothing. France shipped to the Crimea upwards of 300,000 men, and England some 90,000 or 100,000. We cannot doubt, therefore, that either of these powers *can* suddenly equip a large army, transport it over the ocean, 3,000 miles, to our own shores, and maintain it a year or more in a hostile attitude. (The question of being able to maintain a footing on our shores is quite another thing.)

We are struck, too, by the immense power of *creation* possessed by those powers (particularly England) in calling forth all manner of warlike military or naval constructions. It seemed as if the government had but to *will*, and that the immense manufacturing establishments and ship-yards of England were capable of responding to the most unlimited demands, and in the briefest possible time. Taught by the experience of two seasons the inutility of *ordinary* naval means against the Russian defenses in the Baltic, a flotilla of several hundred vessels—gun-boats of different sizes, bearing pieces of the most formidable calibers, mortar vessels, "floating batteries," dispatch vessels, &c., all propelled by steam—were constructed in an incredibly short space of time.*

Such flotillas could be created with the same facility and sent to our shores if there should be found a sufficient motive for it. The third point which attracts attention is the peculiarly *maritime* character of the war. It was not by marching armies into the interior of the enemy's territory, but by assailing his maritime seats of population, wealth, and power, that the war was prosecuted; and one of these great maritime depots became the true seat of war, about which its issue was decided.

The lesson to be derived by ourselves is too obvious to be dwelt upon. *Our own great maritime places* would be the points at which alone an European enemy could hope to strike *great blows*—New York preëminently. If it is left undefended, or is inadequately defended, its immense commerce, its rich depots of wealth and military and naval resources, the lives and property of its citizens, will be, throughout *the whole period of the war*, at an unpitying enemy's mercy; and the national honor will suffer an indelible stain at such a degradation of its great commercial emporium. If defended as it should be, *its defenses must be calculated to grapple with such armaments as we know can and will be brought against it;* and upon the success of the contest immense

* A brief account of these vessels, taken from an interesting paper, "Notes and Observations on Run at Spithead," by Commander W. M. Walker, United States navy, will be found in Appendix C.

consequences, perhaps, as at Sebastopol, the issue of the war will depend.

The boards of engineers who recently had under consideration portions of the defensive system of New York have not been insensible that great additional strength was now required over what had been considered sufficient in former years. But they have never had a time (each member being charged with onerous individual duties) to take that patient survey of the *whole subject* which it requires. Moreover, they have only been called upon to decide projets of particular works; and, I may add, that it is only quite recently that we have had the means of taking this resurvey of our wants with the full light which a perfect knowledge of the events of the European war alone could give us.

It would be presumption in me to say exactly what new works or what new arrangements are required; but I *can* say, with confidence, that the security of New York requires a vast addition to what now exists, and, enlightened by previous labors of the board of engineers, and by the opinions of officers of experience, I can point out, in a general way, what is necessary, or at least what I believe to be so.

First. The Narrows is the great avenue of approach to New York; and the shores being there barely one mile apart, they furnish the means of a most formidable defense. I have before alluded to the difficulty of, by mere array of batteries, absolutely sealing a channel against the *rapid passage* of vessels. The true principle, therefore, for the defense of an object like New York, of such importance that the mere *passage* of batteries would be risked, is not only to make these batteries of the most formidable nature, but so to array batteries that the *entire waters* not only of the channel of approach, but those in which the enemy must lie in his after offensive operations, shall be under their fire.* The board of engineers has already considered the nature and extent of additional works at the Narrows, and, so far as the first condition of a formidable array of batteries is concerned, I think they have met all the requisites. They have decided that there should be, at this passage, batteries sufficient to concentrate a fire of 300 guns *upon any point of a vessel's path within range*. When we consider the character of the armament intended for these works,† it will be admitted that the passage, under the most favorable circumstances, will be a thing of no ordinary risk. Combined with the use of *obstructions*, either floating or fixed, and of floating defenses on our own part, the defense can be made of the most formidable character.

But such an array of batteries does not now exist. To accomplish it, we require on Staten Island, besides Fort Richmond, (nearly completed,) the completion of Fort Tompkins, (just commenced;) the construction of another casemated battery south of Fort Richmond, (for which plans are prepared,) and the extension of the earthen batteries. Fort Tompkins will cost about $650,000, and the new battery and earthen works about as much more—or $1,300,000 in all for the works yet to be constructed on Staten Island.

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* See Appendix D.

† 8-inch and 10-inch columbiads, and 42-pounders, for hot shot, and 8-inch sea-coast howitzers, for shorter ranges.

This is but for the Staten Island side of the Narrows. To provide the concentration of 300 guns upon the passage, and to command the waters of Gravesend bay, the works on the Long Island side must be enlarged by extending batteries (either open or casemated) along the bluff below Fort Hamilton, and Fort Lafayette must be remodeled. As the additional works on this side have not been planned, I can only say that I suppose that an expenditure of about $500,000 will be required on the Long Island shore.

So much for the defenses of the Narrows; but to fulfill the condition that an enemy's fleet shall be kept under fire wherever he may be, one or more works are required to fill the gap between the Narrows and the interior line of works on Bedlow's and Governor's islands.* At least one such work should be built on Robbins' reef—a site about midway between the Narrows and Governor's island, which rakes the approach through the Narrows and commands the outlet of the "Kills." A work on this site may be roughly estimated at $500,000.

The foregoing are what, I think, are imperatively demanded for the Narrows approach to the city. They include (Fort Richmond being nearly completed) the construction of *two* new works on Staten Island, Fort Tompkins, (just commenced,) and the new projected casemated battery; of additional works at Fort Hamilton, and the remodeling of Fort Lafayette, and the construction of at least *one* new work on Robbins' reef, and an expenditure of from two to three millions of dollars. But to prevent the occupation of the outer harbor, and a disembarkation in Gravesend bay, and march on Brooklyn, other works are required, and these may be so arranged, while they fulfill these objects, to add greatly to the risks an enemy would encounter in reaching New York with his fleet.

To prevent disembarkation in Gravesend bay, a work seems indispensable on the point of Coney island; such a work, in conjunction with the proposed new batteries at Fort Hamilton, would sweep the waters of Gravesend bay and take up fire upon a fleet attempting a passage of the Narrows, at a lower point than the Narrows batteries, crossing fire with them. It may, indeed, in conjunction with another work to be mentioned hereafter, be made to contribute *another* and outer line of defense of the Narrows approach.

The work on Sandy Hook, authorized by Congress, and just being commenced, is intended mainly to prevent the occupation and *use* of the outer bay by an enemy's fleet. It does not thoroughly seal all the entrances to that bay; but if the works I have described exist above, he will not encounter the fire of Sandy Hook with no greater object than merely to enter the bay. To make a more perfect defense of these outer waters, however, a work on the "west bank" is desirable, which would command the mouths of all the lesser entrances to the outer harbor, and, in conjunction with the Coney island work, form the outer line of the Narrows defenses already mentioned. Perhaps, too, a work on "Romer's shoal," which would coöperate with Sandy Hook, and command the "swash" and "east" channels, might be deemed expedient.

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*The fulfillment of this condition would be completed by throwing up temporary batteries along the East and North rivers, in the city, and upon the opposite shores.

The work on Sandy Hook will cost $2,000,000, and as to those I have mentioned, it can only be stated that they would require something like $2,000,000 more.

The narrow passage around Staten Island, through the "Kills," can be passed by light-draft gun-boats and similar craft. It can be easily defended by obstructions or shore batteries; but whichever means are resorted to, some shore works, sufficiently strong to endure an assault are necessary; I only point out the fact, without attempting to indicate what they should be.

The East river approach is defended by the formidable work of Fort Schuyler; another work opposite to it, on Willet's Point, is deemed necessary, and the two will, with such auxiliary means as can be easily provided in time of war, complete the defense. The work on Willet's Point may be built probably at the same cost as Fort Schuyler, $800,000.

I have now indicated, in a very general way, what I suppose necessary to put New York in satisfactory state of security. I have shown, or have attempted to show, not only that it was *not* now in such a state, but that works requiring some six or eight millions of dollars are imperatively demanded. The sum is large, it is true; *but it is only about the amount of revenue collected here in two months.* If I have convinced you, as I have tried to do, and, as I certainly believe, that in our next war with a great maritime power more important issues will be involved, in the adequate defense of New York, than upon almost any other preparation, defensive or offensive, we can make, *then* I shall not fear that you or the *nation* will consider the millions required disproportionate to the object. I believe that the people of the United States can and will be made to understand that the defense of New York is a *national* and not a local question, and as such will be willing to provide for it.

If I am asked when these works should be undertaken, I answer that I consider that all those that involve the defense of the Narrows are so immensely important to New York that they should be commenced *immediately* and carried on with the largest appropriations that can be advantageously applied to completion; and simultaneously with these, the work on Coney island. These works (Fort Tompkins, the new water battery on Staten Island, the additional works at Fort Hamilton, and the work on Coney island) will cost about $2,000,000, and I urgently recommend that at least $500,000 be asked from Congress for them.

The works just mentioned, with the work on Sandy Hook, also in progress, would place this approach in a respectable state of defense, and the other works in the outer bay could be commenced at a later period; but *all* that are decided by competent authority to be necessary should be built as soon as possible.

A complete view of the "dangers and defenses of New York" requires some allusion to the subject of an invasion by land, and particularly from Long Island. The idea of such a danger has nothing whatever of novelty in it. That the British army actually *did* land in Gravesend bay, defeat the continental forces under General Washington at Brooklyn, and capture New York, is well known. That to prevent the repetition of such an operation during the last war, a large body of

militia was called out, is equally well known, and the liability to a repetition of such an attack has been dwelt upon in almost every official paper treating of the defenses of New York.

The chief engineer, General Totten, proposed to secure the city from danger in this particular quarter by an *outer barrier;* and if the outer bay could be *effectually closed*, of course the danger would be removed; but so to close it will require works* which, if built at all, will not probably be very soon.

The subject has been before almost every board of engineers that has had the defense of New York under consideration from 1816 to the present time. They have presented no formal plan, that I recollect, for land defenses on Long Island, (at least not of late years,) for they have always found other demands concerning the defenses of New York far more pressing, and have probably thought, too, that while the general character of the defense was sufficiently obvious, every year that elapsed would alter the details of the problem.

There are two or three very broad principles bearing on this subject, which, I think, every one will assent to.

First. A landing in the face of such a force as could speedily be concentrated (or rather, such as always would *be at hand* in New York) is an operation of great risk as well as great labor, and requiring special means and arrangements. *No enemy will take this course so long as he can with his fleet* (or with vessels properly adapted to the object) *reach the city and effect his object without landing.* While, therefore, this latter operation is open to an enemy—while he can with his fleet, or the gun-boats, or floating batteries of his fleet, force his way within range of the city from his shell guns, or curved fires, the question of danger from land attack sinks into insignificance.

The works to prevent the former operation are of great magnitude, as I have endeavored to show in the course of this paper; require large amounts of money and much time to complete. Those to prevent the latter (land attack) are of a comparatively trivial character. I concur, in fact, with the opinion expressed by yourself, sir, in your annual report, that (at least until the *harbor* defenses are completed) nothing but earth works, to be thrown up *in time of war*, are necessary.†

Second. All the arguments which opponents of our system of coast defense have of late years brought forward *bear with their full force* upon our defensive strength *in this relation; not at all* upon the degree of strength required for *harbor defenses.* Lieutenant Maury thinks, "If the greatest army that was ever led into battle by the greatest captain were to land on Long Island, and be disembarking his last piece of artillery before he was discovered, these railroads, the power of steam with the aid of lightning, would enable the government, before he could reach the hights of Brooklyn, to have there in waiting and ready to receive him, and beat him back into the sea, a force two to one greater than his, *however strong;*" and Major W. H. Chase (in a quotation already given) has expressed views, if not quite so strong

* It is not anticipated that the work on Sandy Hook can alone close this bay.

† I consider, however, that the work on Coney island should be *immediately* built to prevent a landing in Gravesend bay or on Coney island; but this is not included in the category of *land* defenses, as advocated by others.

as these, somewhat similar. It is not necessary to embrace the particular views of either of these officers to acknowledge that there is force in their arguments.

Third. The *great danger* to New York and its dependencies from this kind of an attack is from the safe and convenient landing at Gravesend bay, and the short line of march thence to Brooklyn. Should we find ourselves engaged in war, with no other defenses in this quarter than those now existing, prompt and energetic measures would have to be taken to improvise a defense against this danger; and doubtless prompt and energetic measures could and *would* be taken.

With the work I propose on Coney island, however, this landing becomes unavailable, and the danger of land attack on Brooklyn or New York becomes comparatively insignificant. A landing, as before remarked, in the face of the dense and warlike population of New York, augmented as the numerical force of its defenders may be in a day or two by overwhelming numbers from other quarters, is one of the most dangerous operations of war. It will not be undertaken *on the open sea-shore* of Long Island, where at any moment the disembarked force would be liable to have its communication with its fleet cut off. It would only be made from Long Island sound, whence a march of 15 or 20 miles at the shortest would be necessary to reach Brooklyn. At whatever rate such a danger may be estimated, it is sufficient to say that in 24 hours after a declaration of war (if thought necessary) an army of 50,000 men may be *intrenched* on the line of approach to Brooklyn.

The work on Willet's Point will by no means have an insignificant bearing on such defense. To "leave it behind" is not simply to leave a "fortification" in the enemy's rear: it is to have in his rear *an intrenched "tête de pont,"* whence in 24 hours an *overwhelming force may be thrown from the New York side upon his rear, cutting him off from his fleet.*

In conclusion, I would say in this connection that the policy of our government and of the Engineer department has always *been* (and, I conceive, always should be) *first* to close all the great approaches by water leading to our dock-yards, commercial cities, &c., and to locate those defenses in such a manner *as to force any landing that may be attempted to as great a distance as possible.*

The defense against approaches by an army landing must be by our troops, (surely, if the nation and the people have in themselves any inherent power of self-defense, it is *here* they can meet the foe, and "hurl him back to the ocean,") with the assistance of temporary works, and all the expedients of engineering talent and skill, on *such route* as an enemy may have selected. But to leave the coast and construct a girdle of forts about any of our cities, as they now exist, would be as wise as to have constructed permanent defense along Brooklyn and Harlem hights, when they were made in 1814 and 1815 on ground now within the cities, and to be traced or known only from old maps and plans. Fort Greene, one of the commanding sites of the Brooklyn line of 1814 and 1815, has been not only occupied by the city, but its commanding eminence leveled. Nothing short of the power of a despotic government, with ability to take possession of hundreds of acres, (and dwellings,) and *forbid the erection* of any structures either upon

the sites or *within gun-shot of them*, could accomplish the scheme of either establishing a girdle of works about Brooklyn, or secure permanently the sites of them. The fact that sites deemed eligible *now* are being built upon is the best proof that they are becoming no longer so.

Whether these propositions are admitted or not, it is most certain that at present the great "dangers" of New York are through *the inadequately defended water approaches*. It is to *these* dangers I most urgently call your attention, and the attention of Congress, and of the people of the United States; for it is not a question of local but of *national* concern.

This paper has swollen to a length quite unanticipated by me in commencing it, but I have judged it important, at a period in our growth as a nation, and the history of our relations with the other great powers of the world, when I conceive the subject of security to our great cities and ports has acquired more than ordinary urgency—when, at the same time, the very principles on which such security can be obtained are called in question—to review *thoroughly* the whole subject, glancing at the arguments of past years to see how they have been justified by the progress of events, and discussing at length the facts in the recent European war which bear on this subject. If I shall convince you, sir, that there is urgent and immediate necessity for prosecuting, in the most energetic manner, *all the defensive* works now authorized by Congress for the defense of New York; of commencing *new ones* without delay; and if, by means of this paper, I shall awaken the attention, not only of the people of New York, but of *all* who take the "safety, honor, and welfare" of their country to heart, to the importance of this subject, my object will be accomplished.

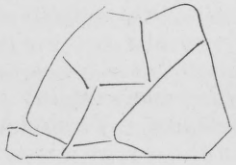
Appendix A.

The following description of the manner of construction and materials used in some of the Russian and Prussian works (Bomarsund among other works) will illustrate the degree of authority belonging to the assertion quoted, and may be relied upon as substantially correct.

The masonry is described as of boulders, with one end broken off to form the face, then the sides broken to give beds and builds of every variety of shape, number of sides, length, &c. No stone other than the Finland granite, scattered over the surface in boulders is available in a large part of Northern Europe. These are used for the face of the wall, the filling being brick or other masonry.

The result is a facing of most excellent materials for durability as to time, but very inferior, and of little or no strength in bond. The stones are left with rounded surfaces on the back, and present no bond of any value; and in size vary as they were picked from the fields, every stone being worked to its largest dimensions for a face, and cut to fit the adjacent ones previously laid.

Thus, for example, the face of the wall is formed:



The joints perpendicular to the face, as a necessary consequence, vary in depth, according to the size of the boulder, and the bed into which it is being prepared to be laid, varying from 6 to 12 inches in a work, observed under construction. None of the stones could be considered as large, and the masonry may be considered as of an exceedingly indifferent character to resist artillery, although good against weather and escalade. Of such were the Bomarsund towers, and casemated water battery. At Cronstadt the masonry of the scarps on the water fronts is superior to any masonry to be found in the fortifications of Europe, and equal in every respect to that in our dry-docks at Brooklyn and Norfolk. At Sebastopol it was very indifferent as to the size and quality of the materials, though well put together, of headers and stretchers, with horizontal beds and vertical joints, but in pieces from 8 to 12 inches rise, and 2 to 4 feet in length for the stretchers; the mortar not very hard. The copying of the docks and sea-wall of the dock harbor was excellent, of large blocks of Finland granite, and what appeared to be Quincy granite; but the scarps of the Malakoff, the crenated wall on the west of the city and the harbor casemated forts were very poor masonry, both in quality of material and its small size; the material not as good as Connecticut sandstone in our harbor defenses.

Appendix B.

The following more detailed account of the defenses of Cronstadt and Sebastopol is condensed from an authentic source.

The Russians gave their attention, first, to secure the dock-yards and establishment at Cronstadt. By permanent casemated batteries, upon precisely the same principles we have adopted, (differing in some details only,) they closed the main entrance against large and small vessels, and were adding, during the existence of the contest, to these casemated defenses in the construction of a new work on the shoal opposite Cronstadt, (north side of main channel.) The narrow circuitous channel through the shoals, from the island of Cronstadt to the Finland shore, was defended by hulk-ships permanently anchored at advantageous positions, as was likewise the shoal water between the island of Cronstadt and the mainland to the southward. A numerous flotilla of steam propellers and sailing gun-boats, with many boats propelled with oars, armed, each, with a heavy gun, together with many steam sloops-of-war, were ready to operate anywhere about or on the shoals, where their services would be most available, at any moment.

The city of Cronstadt, on the eastern end of the island, was inclosed by permanent fortifications. On the western side, crossing the island, these works took in every building of the commercial city and naval dock-yards, but were so near the latter as to have brought destruction upon city and naval establishment by any siege operations carried on against the permanent defenses. To obviate this serious difficulty a line of intrenchments was thrown up across the island, far in advance of the permanent works. These intrenchments were armed with heavy ships' guns, with ditches commanded by concealed caponniers, fraised and palisaded. Such was the defense of the main ship channel to St. Petersburg, and the naval establishment, against floating offensive operations. Within this line the city of St. Petersburg is approached only through shoal water and among islands. All these channels were commanded by temporarily constructed batteries, mounting from six to twelve heavy guns on wrought-iron carriages. But the city of St. Petersburg on the land, and the whole coast and shores from it, down to the enemy's anchorage on the north and south, were bare lines or intrenchments of any kind. A large army was in camp south of St. Petersburg ready to march at any moment to oppose a landing, or meet any troops the allies might venture to land. Both at Cronstadt and Sebastopol, as well as Sweaborg, Bomarsund, and Riga, the defenses were in progress of construction, or rather unfinished; those at Cronstadt being actually under construction, both in the dock-yard and casemated forts; but the land defenses they had the good sense to *omit* until the great and open route *by water* had *been secured*. This latter object they had most successfully attained at Sebastopol, whose harbor defenses resisted the combined attack of the most powerful armament Europe could bring to bear against any works, and they effectually served to protect the fleet, dock-yards, city,

and all they were destined to secure. But time did not enable the Russians to carry out their plans to cover the land side of these harbor defenses. On the west of the city they had a crenated scarp, which held out to the last against the French. Along the south they had nothing but the little Malakoff tower of two tiers of loop-holes for infantry, and five guns in barbette; a work with a circular trace, the gorge not exceeding twenty-seven feet radius, (out to out,) admitting of five loop-holes only on each side of the door. Temporary earthen works were hastily thrown up on ground most advantageously formed for such a noble and gallant defense as the Russian engineer's skill enabled him to organize, with the resources of an immense fleet to arm and equip them. A first, second, and even third line of defenses, the two latter always in advance of their first, occupied positions on the crest of the dock-yard hills; the Russian engineers pushed forward to meet the enemy's approaches; but no permanent works of any kind existed to oppose the allies on the south, saving the little exposed masonry Malakoff, the stone of which was no better than some of our best mortar, and which was destroyed from a distance of more than 1,500 yards by the first battery constructed against it. There can be no doubt that the Russians labored under every disadvantage from the temporary character of their works; and it is very certain that neither the Redan or Komiloff bastion (the Malakoff) would have been entered by a French or English soldier to the day the Russians evacuated them, had there existed either a masonry COUNTERSCARP or SCARP, with suitable BOMB-PROOFS for the Russian troops. Another winter's campaign would unquestionably have been necessary had the works been of this more permanent character, and it may well be doubted whether the renown of the allies could have equalled such a prolonged contest.

APPENDIX C.

"The floating batteries are of very uncouth and unwieldy appearance, partaking in model about equally of a canal boat and a galliot."

"In general, their construction is that of iron ships; the decks are of 9-inch plank resting upon 10½-inch beams placed 1 foot 9 inches from center to center; the 'top sides' are covered with 6-inch plank, over which, extending to 3 feet below the water line, is a sheathing of wrought-iron plates 14 feet long, 20 inches wide, and 4½ inches thick, each secured to the hull by 1¼-inch screw bolts."

"They are brig-rigged, are fitted with non-condensing engines and screw propellers, and can make under steam alone 4½ to 5 knots."

They are pierced for 30 guns, and mount from 14 to 16 68's.

Dimensions.

	Horse power.	Length.	Extreme breadth.	Depth.	Draught.
"Meteor".....	150	173	43.6	14.7	7.9
"Thunderbolt"....	200	186	48.6	18.6	7.6

"The only vessel of this class which has been tested in action was under French colors in the attack upon Kinburn. She was struck in the hull 58 times, without receiving any other injury than the indentation of the plates to depths varying from one-fourth to one and one-fourth inch. Of important particulars respecting the alleged invulnerability of these vessels I could get no account, and must admit a want of faith in it."

"The mortar-boats are cutter-rigged vessels of about 70 tons, very much resembling in general form and appearance the 'Anchor Hoy,' which was formerly, and perhaps still may be, attached to the Norfolk navy yard. Their draught is five feet. Each mounts a 13-inch mortar."

"*Gun-boats.*—The largest of these vessels are three-masted schooners, of fine models, of 800 tons, and 210 feet long, with engines of 350 horse-power, and a speed under steam of 10 to 11½ knots."

"They have a crew of 100 men, and their armament consists of two 68-pounders of 95 cwt., on pivots, one between the fore and the main masts and one on the forecastle, and four 32-pounders on truck carriages. The most noteworthy peculiarity of these craft is the arrangement of their boilers, which is as follows: Their light draught renders it impossible to place the boilers out of danger below the water-line, without occupying two much of the floor of the vessel; therefore they are furnished with two descriptions of boilers—the 'service' and the 'fighting' boiler. The first is of the usual form of British marine boiler; the latter, cylinder tubuler. For ordinary service both boilers are used, but in close action the lower or 'fighting' boilers, only these being sufficient to furnish rather more than half speed."

The second class gun-boats are schooners of 650 tons and 180 feet long, with engines of 200 horse-power, and a speed under steam of nine knots. They are manned with 80 men, and mount, on pivots, one 68-pounder of 95 cwt. and one 32-pounder of 65 cwt., and four 12-pounder howitzers.

"The third class, the most numerous, are schooners of about 110 feet in length, with engines of 60 horse-power, and a speed under steam of eight knots, with a draught of about 6½ feet; they have a crew of 40 men, and the same armament as the second class."

"The fourth class are schooners of 80 feet in length, a draft of five feet, engines of 20 horse power, and a speed, under steam, of six knots; a crew of 30 men, and are armed, a part of them with one 68-pounder and one 32-pounder, others with two 32-pounders.

"The two latter classes are provided with movable shields of iron plate, bullet proof, which are shipped at pleasure; raising the hight of the bulwarks to about seven feet in case of having to force a passage defended by riflemen. The engines of all these vessels are 'non-condensing' 'direct acting,' of great simplicity and compactness, and work to three times their nominal power. They usually carry a pressure of 60 pounds; the 'boilers' are tested to 180, and such is the fidelity with which the work has been executed, that no break-down or accident has yet occurred on board of any one of them."

NOTE.—A more detailed description of these vessels is given by Major Delafield, corps of engineers, (in his report to the War Depart-

ment as one of the military commission to Europe,) together with a vast amount of other information bearing upon the topics which this paper treats.

The report, unfortunately for the progress of military science, has not yet seen the light; and my official duties have prevented my consulting the MSS. in Washington while preparing this paper.

Appendix D.

The engineers are not the inventors nor makers of ordnance; they can but apply to the best advantage such as is supplied to them.

It does strike me that its construction should, so far as it is intended for harbor defense, be studied exclusively in the light of its adaptability to that object, and without regard to *conformity* to other models. Large calibers are *imperatively* demanded for coast defense, nor is there any objection arising from the *weight* of the guns, which applies strongly in naval use.

Yet the navy have sucessfully introduced a gun, (Dahlgren's 11-inch gun,) which throws solid shot one-third heavier than our 10-inch columbiad.

It is even reported that the Ordnance department are about abandoning the use of the *solid shot* in our 10-inch guns, as if, against these new means of attack, (iron clad floating batteries constructed *expressly* to batter our fortifications,) a 10-inch shell could have any effect whatever.

If we must throw *shells*, at least let us throw them of such size that they may have thickness enough not to break against any thickness of iron a vessel's side may oppose. Let us make them such that (to use the sportman's phrase) "every shot shall be a bird."

The Turks have for the defense of the Dardanelles guns of 30-inches caliber, carrying a stone ball. I do not know whether there is any real impossibility or impracticability with us in the construction of guns of that caliber, but I cannot see why a gun of greatly superior caliber to anything we now have should not be made expressly for harbor defense.

Such guns could not be fired with the rapidity of smaller ones; perhaps, too, like the Turkish guns, it would be found best to establish them on fixed lines of direction; but one such shot that *hits* would be worth a hundred smaller ones, a 30-inch hole could not be plugged, and the explosion of a 30-inch shell would send a vessel to the bottom.

Of the capability of such guns to inflict injury, and of the efficiency of batteries armed with them, an opinion may be formed by the single instance (so far as I know) in which their qualities have been exhibited, viz: the retreat in 1807 of the fleet of Admiral Duckforth. "The defenses of the channel had been allowed to go to decay; but few guns were mounted, and the forts were but partially garrisoned."

"In Constantinople not a gun was mounted and no preparations for defense were made; indeed, previous to the approach of the fleet, the

Turks had not determined whether to ride with the English or the French, and even then the French ambassador had the greatest difficulty in persuading them to resist the demands of Duckforth."

"The British fleet consisted of six sail-of-the-line, two frigates, two sloops, and several bomb-vessels, carrying eight hundred and eighteen guns (besides those in the bomb-ships.)

"Admiral Duckforth sailed through the Dardanelles on the 19th of February, 1807, with little or no opposition. This being a Turkish festival day, the soldiers of the scanty garrison were enjoying the festivities of the occasion, and none were left to serve the few guns of the forts which had been prepared for defense."

"But while the admiral was waiting on the sea of Marmora for the results of negotiations, or for a favorable wind to make the attack upon Constantinople, the fortifications of this city were put in order, and the Turks actively employed, under French engineers and artillery officers, in repairing the defenses of the straits."

Campbell in his Naval History, says:

"Admiral Duckforth now fully perceived the critical situation in which he was placed. He might, indeed, succeed, should the weather become favorable, in bombarding Constantinople, but unless the bombardment should prove completely successful in forcing the Turks to pacific terms, the injury he might do to the city would not compensate for the damage which his fleet must necessarily sustain.

"With this damaged and crippled fleet he must repass the Dardanelles, now rendered infinitely stronger than they were when he came through them. Under these circumstances the admiral determined to retreat; and on the 3d of April escaped through the Dardanelles, steering midway of the channel with a favorable and strong current."

"This escape, however," says Baines, "was only from destruction; but by no means from serious loss and injury. * * * *

"In what instance, in the whole course of our naval warfare, have ships received equal damage in so short a time as in this extraordinary enterprise?

"In detailing the extent of this damage we will take the ships in the order they descended:

"The first had her wheel carried away and her hull much damaged, but escaped with the loss of only three men.

"A stone shot penetrated the second between the poop and quarter deck, badly injured the mizzen-mast, carried away the wheel, and did other serious damage; killing and wounding twenty men.

"Two shot struck the third, carrying away her shrouds and injuring her masts; loss in killed and wounded, thirty.

"The fourth had her mainmast destroyed, with a loss of sixteen.

"The fifth had a large shot, six feet eight inches in circumference, enter her lower deck; loss fifty-five.

"The sixth not injured.

"The seventh a good deal damaged, with a loss of seventeen.

"The eighth had no loss.

"The ninth was so much injured that had there been a necessity for hauling the wind on the opposite tack she must have gone down; her loss was eight.

"The tenth lost twelve.

"The eleventh was much injured, with a loss of eight—making a total loss in repassing the Dardanelles of one hundred and sixty-seven; and in the whole expedition two hundred and eighty-one, exclusive of two hundred and fifty men who perished in the burning of the Ajax."

Such was the effect produced on the British fleet, sailing with a favorable wind and strong current, past the half-armed and half-manned forts of the Dardanelles. Duckforth himself says that had he remained before Constantinople much longer, till the forts had been completely put in order, no return would have been open to him, and the unavoidable sacrifice of the squadron must have been the consequence.

Scarcely had the fleet cleared the straits before it (the fleet) was reinforced with eight sail-of-the-line; but even with this vast increase of strength the English did not venture to renew the contest. They had effected a most fortunate escape.

General Jomini says that if the defense had "been conducted by a more enterprising and experienced people, the expedition would have cost the English their whole squadron."*

Truly, if half dilapidated batteries (worked probably by inexperienced hands) could inflict these severe damages upon a fleet not engaged in actual contest, but merely trying to run by under the most favorable circumstances of wind and tide, what might not batteries of such guns be capable of, judiciously arranged and skillfully managed?

"In what instance," says Ad. Raines, "in the whole course of our naval warfare have ships received equal damage in so short a time as in this extraordinary enterprise?"

It is to be remembered, however, that we have as yet had no fair instance of the power of modern *shell-guns* from land batteries against ordinary ships-of-war. In the few direct contests which the allies had with the Russian fortifications, the modern armament does not appear to have existed, and where shells were thrown from guns they appear to have been of inferior caliber. Yet the Russians with the shell-guns of their fleet blew up two Turkish frigates at Sinope *in fifteen minutes*.

One of the main causes of inefficiency in coast batteries, which has given color to the idea that they may be passed or even *attacked* with impunity, I conceive to be the want of skill and *care* in the use of the guns. The result is a prodigious smoke, and a prodigious throwing away of balls, and very little damage done. This has been, however, by no means a *peculiarity* of coast defense. The same system of random firing has hitherto prevailed, both in the use of small arms in land and of heavy ordnance in sea battles; nor has it occurred apparently to even the greatest masters of the art of war, to ask why, for one man wounded, or for one effective shot in a vessel's hull, so many thousand of shot should be thrown uselessly into the air.

But this question is *now* asked both in the use of the soldier's rifled musket, and in the management of ship's guns, as well as of artillery of all kinds.

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*"Halleck, military art and science."

It is at last discovered that it is of more importance to teach the soldier to direct his piece with accuracy of aim than to perform certain motions on parade with the precision of an automaton. The same idea is now infused into all the departments of military and naval science, and is a *necessary* result of the recent great improvements in the construction of arms.

In short, the truth has at last become apparent that the old fashioned system of random firing, though, perhaps, like the charge of the six hundred at Balaklava, "bien magnifique, *n'est pas la guerre.*"

It is of the utmost importance that we should apply this principle to the management of our sea-coast batteries and give it a practical effect.

The *volunteers* of our cities will constitute mainly, in time of war, the garrison of our forts and manipulators of our sea-coast guns. In time of war they will probably be exercised in these duties. But it is most desirable that we should have *at all times* a body of gunners practiced in these exercises. The result would be not only to give to our *citizens* as well as citizen soldiers confidence in the defenses provided for their security, but it would disseminate military knowledge and an intelligent idea of the bearing and objects of the different defensive works. To carry out this idea, it would be desirable that there should be at each considerable seaport town a sufficient garrison of *artillery* troops to aid in the instruction of the volunteers. In the present condition of the army *this* cannot be hoped, but perhaps it might, at least, be found practicable to detail an artillery officer or two for this purpose.

Appendix E.

On the relative value and strength of earthen and masonry revetted works the following extracts will be read with interest:

The first is from the report of Captain George B. McLellan, 1st cavalry, (one of the military commission to Europe:)

"This would seem to be the proper place to notice a popular fallacy, which, for a time at least, gained extensive credence. It was that the siege of Sebastopol proved the superiority of temporary (earthen) fortifications over those of a permanent nature."

"It is easy to show that it proved nothing of the kind, but that it only proved that temporary works in the hands of a brave and skillful garrison are susceptible of a longer defense than was generally supposed."

"They were attacked as field works never were before, and were defended as field works never had been defended." "The main difference between properly constructed permanent fortifications (intended to resist a siege) and temporary works is, that the latter seldom present an insuperable obstacle against assault, while the former always do.

"In addition, permanent works have a better command over the adjacent country, and are more carefully planned." "The masonry walls, which render an assault impossible, cannot be seen from the

distance, and can be destroyed only by establishing batteries on the crest of the glacis or the edge of the ditch; the earthen parapets alone being visible beyond that point, they may, until the besiegers arrive there, be regarded in the same light as field works, with the difference that the garrison are not harassed by the necessity of being constantly prepared to repel an assault."

"Now, in the siege of Sebastopol, the trenches of the besiegers never reached the edge of the ditch; so that had the fortification been a permanent one, the most difficult, slow, and dangerous part of the siege remained to be undertaken, viz: the crowning of the covered way, the establishment of the breach batteries, the descent and passage of the ditch, and the assault of the breach; in other words, at the moment when the weakness of the temporary works became apparent and fatal, the true strength of the permanent defenses would have commenced coming into play.

"Assuming the progress of the attack to have been as rapid as it was under existing circumstances, the besiegers, on 8th of September, would not yet have been in a condition to crown the covered way, the siege would certainly have extended into the winter, and it may even be doubted whether the place would eventually have fallen until the allies were in sufficient force to invest the north as well as the south side."

These views are, I believe, fully sustained by the other commissioners, Majors Delafield of the engineers and Mordecai of the ordnance corps.

But a more remarkable confirmation is found in the recently published "Journal of the operations of the Engineers" at the siege of Sebastopol, by the French engineer-in-chief, General Niel, which I also extract. It furnishes, at the same time, a simple and intelligible explanation of the extraordinary length of the defense of that place:

"Struck by the length of the siege of Sebastopol, certain foreign officers have expressed the opinion that masonry revetted scarps are not of incontestible utility in fortified places."

"Sebastopol, a vast retrenched camp, defended by field fortifications of strong profile, derived its principal strength, from an armament such as could only exist in an extensive maritime arsenal, and from a large army which always preserved its free communication with the interior of Russia."

"If the enceinte had been provided with good revetted scarps—if it had been necessary to breach these, and subsequently been compelled to penetrate through difficult passages, in rear of which the heads of our columns would have met an army, Sebastopol would have been an impregnable fortress."

"When we compare in effect the works of attack at Sebastopol with those of an ordinary siege, we will see that on the 8th of September, 1855, the day of the last assault, we had only executed, after the greatest efforts, the besieging works which precede the crowning of the covered way; we had not then, as yet, entered upon that period of the works of a siege, which are the most difficult and most murderous; and there was no occasion to engage ourselves in them, since the ditches

and parapets of the enceinte were not insurmountable, as the sequel has proved."

"The difficulty consisted in conquering the Russian army upon a position prepared long beforehand for its defense, quite as much as in surmounting the material obstacle of the fortifications. Our places of arms being established at thirty miles from besieged works, we were able to choose our own time for action, and to throw ourselves unexpectedly upon the enemy when the fire of our artillery had forced him to shelter himself up to the last minute behind his numerous blindages; to have gone further would have been inviting the initiative in the attack on the part of the Russian army.

"The absence of scarp walls, which would have secured the place from escalade, did not exercise a less influence upon the defense, for the besieged were compelled to keep permanently at the gorges of the works strong reserves in readiness to repulse the assault which they saw themselves menaced with from the commencement of the siege.

"Finally, it can be remarked that these reserves, which were decemi-nated night and day by the concentric fires of our batteries, were able to issue out from the enceinte through wide dibouches without having to pass through the narrow defiles which are formed by the draw-bridges of revetted places; they were then a permanent threat for the besiegers who were exposed to seeing their trenches unexpectedly invaded by the greater part of the Russian army."

"Neither side, consequently, was in a position analogous to that which is presented in the siege of a fortified place, protected from insult by good masonry scarps."

In another place the same authority has the following remark, which I quote. (Italics are mine:)

"Now, it (the Russian army) *is no longer able to escape from the concentric fires of our batteries;* for, *not being protected by masonry scarps*, it is obliged constantly to keep united strong reserves, in order to repulse the assault with which it is at every instant menaced."